

Scientific careers from the point of view of male and female students

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In the framework of the Pisa Masterclass of particle physics, each year a questionnaire is given to the students to assess if the Masterclass met a positive response. Together with specific questions about the various activities they took part in during the Masterclass day, we ask them if they would like to become a scientist. They are offered 15 possible motivations for a “yes” or a “no” to choose from. This year, in order to increase the statistics, we gave the same questionnaire also to groups of students attending the Masterclass in other Italian universities. We expect this sample to be enriched in students interested in scientific disciplines. On the other hand, we gave a reduced version of the questionnaire also to students attending the last year of high-school but not taking part to the Masterclass. We expect this last sample to be enriched in students not necessarily interested in scientific disciplines. The data have been analysed from a gender perspective. With this study we try to investigate if male and female students have a different perception of scientific careers and to get hints on how to intervene to correct the path that seems to naturally bring male students towards STEM disciplines (science, technology, engineering, and mathematics) and reject female students from them.

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1. Introduction

The particle physics Masterclass (MC) is an international outreach activity which provides an opportunity for high school students to discover particle physics [1]. Students spend one day in Universities and Research Institutes where they work as scientists: first they listen to introductory talks on particle physics, accelerators and particle detectors, then they make measurements using real LHC data. At the end of the day 5–6 groups of students all around Europe join in a videoconference moderated from CERN to discuss and combine the results of their measurements.

The Pisa unit of the National Institute for Nuclear Physics joined the MC since the first year, in 2005 (World Year of Physics) [2]. Each year more than a hundred students (18–19 years old) come to our research center. They are selected by their schools, based on previous year grades and taking into account their expression of interest for the initiative. Since a few years we ask teachers to reflect the “gender” distribution of the school in the list of selected students.

At the end of the MC day a questionnaire is given to the students to assess if the MC met a positive response. Together with specific questions about the various MC activities, we ask them if they would like to become a scientist. The data collected since 2010 have been analyzed from a gender perspective [3]. About 620 Pisa students filled the questionnaire, 380 male and 240 female students.

2. Analysis of the questionnaire: would you like to be a scientist?

We ask the students: *would you like to work or do research in a STEM (physics, technology, engineering, and mathematics) discipline?*

They are offered many options to choose from, and are asked to select up to a maximum of five reasons for a “yes” or a “no” among the ones listed here.

Yes because:

- It's s easy to find a job;
- I have a talent for science;
- I see myself as a scientist;
- I like science;
- I like to do things that are considered difficult;
- I like the idea of studying the mysteries of the universe and finding answers to new questions;
- I'm not scared by the idea of working in a lab, without regular meals and hours;
- One can make a lot of money in science;
- It's a field where one can travel a lot;
- The choice of career has a high priority in my life;
- It would make my life more interesting;
- I'm not scared by the prospects of an all-encompassing job;
- I deeply admire scientists and consider them a role model;
- My teachers are encouraging and are advising me to undertake a scientific career;
- My family is encouraging me and would be very happy if I were to choose a scientific career.

No, because:

- It's difficult to find a job;

- I have no talent for science;
- I cannot see myself as a scientist;
- I don't like science;
- Scientific disciplines are too difficult;
- One has to study too much;
- I would like to do more useful work;
- Working in a lab without regular meals and hours is not for me;
- I put my personal interests first;
- I don't want to sacrifice my personal life for my career;
- I aspire to a normal life;
- I'm scared by the prospects of an all-encompassing job: I want to have time for myself;
- There aren't scientists who I consider as a model;
- My teachers are discouraging me;
- My family is discouraging me.

87% of male and 78% of female students attending the MC in Pisa answered “yes”. Figure 1 shows the distribution of the “yes” motivations.

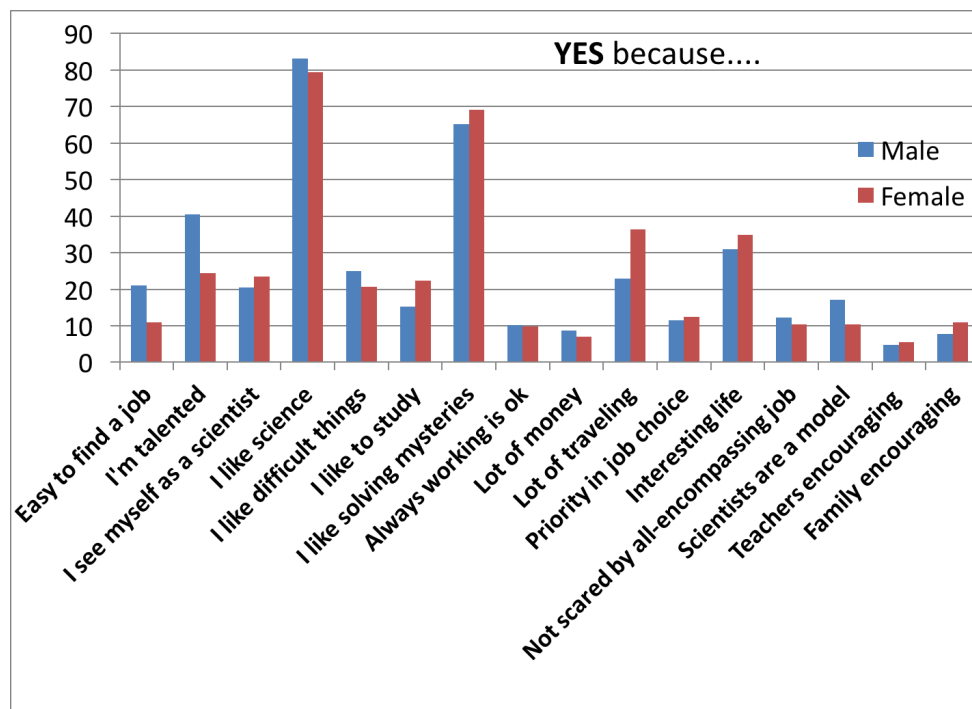


Figure 1: Distribution (in %) of the motivations for willing to be a scientist for Pisa students.

3. First control sample: Italian students

In 2017 the same questionnaire was proposed for the first time to all the Italian INFN units taking part to the MC. The answers collected in some of the Italian research Institutes and Universities (Bologna, Cagliari, Cosenza, Lecce, Milano, Pavia, Padova, Perugia, Roma, Torino, and

Trento) amount to about 570 male and 300 female students. Among these, 90% of male and 82% of female answered “yes” to the “would you like to be a scientist” question. The corresponding distribution of the “yes” motivations is shown in Figure 2.

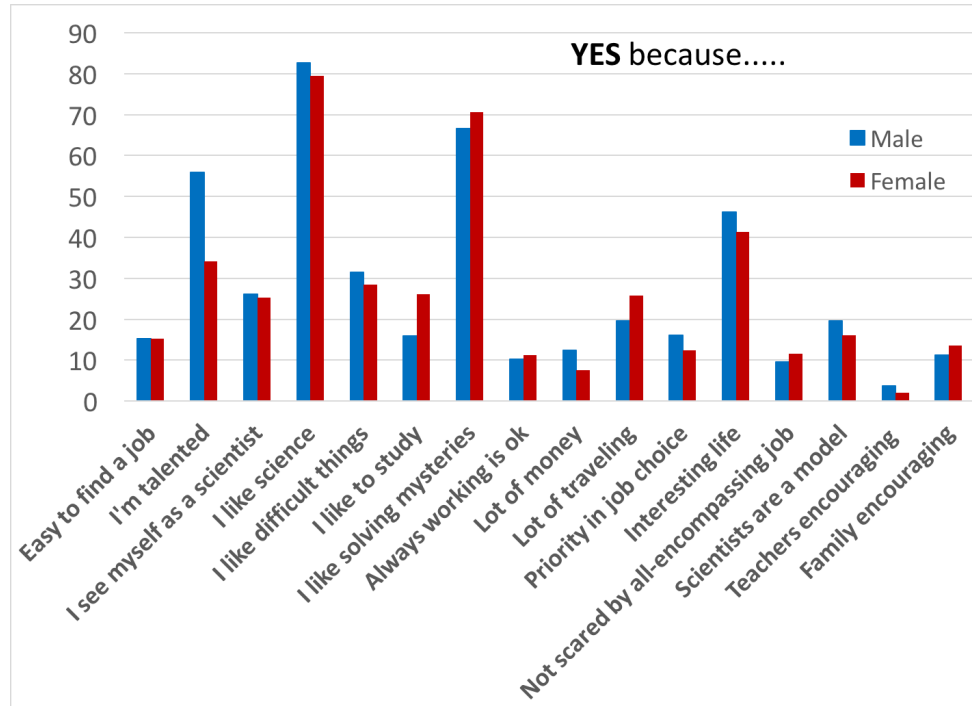


Figure 2: Distribution (in %) of the motivations for willing to be a scientist for students from other Italian cities.

One can notice from both “yes” distributions that more male than female students answer that they have a talent for science. On the other hand, more female than male students are attracted by the idea of traveling.

4. Second control sample: Pisa students not attending the Masterclass.

Since only a small percentage of students taking part to the MC answered “no” to the “would you like to be a scientist” question, in order to increase the statistics we asked this question also to about 310 students attending the last year of high school in the Pisa area but not taking part to the MC. We expect this “control sample” to be enriched in students not necessarily interested in science as a career. The percentage of “no” answers is actually higher in this group than for students taking part to the MC. Putting all the “no” answers together, we collected about 125 “no” answers from male and 175 from female students. The results for the “no” motivations are shown in Figure 3. Here more female than male students feel that they are not talented enough for science. On the other hand, more male than female say that science is too difficult and that they are scared by the prospects of an all-encompassing job. It appears that the opinion and encouragement/discouragement of teachers and/or family is not as relevant as one would expect.

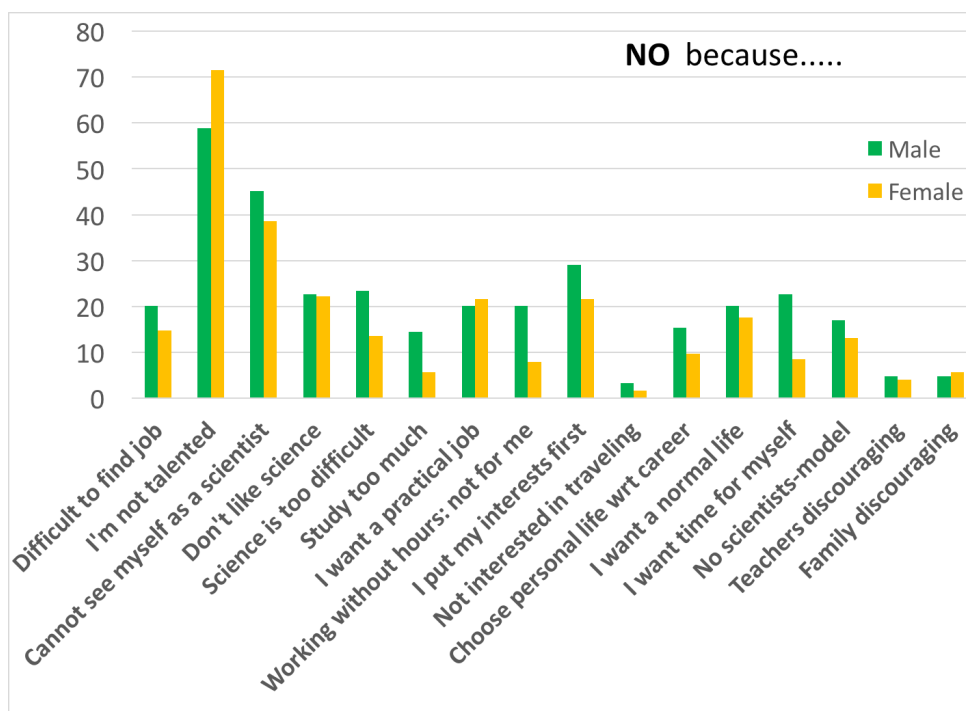


Figure 3: Distribution (in %) of the motivations for not willing to be a scientist.

5. Conclusion

Attracting female students to science and technology-related careers is a real issue in the European countries. With this study we aim to assess if male and female students have a different perception of scientific careers. A partial analysis of the answers to more than 600 questionnaires filled by students attending the Masterclass in Pisa from 2010 to 2017 is presented. We complemented this analysis by distributing the same questionnaire also to other Italian INFN units taking part to the MC. The motivations for the students who declared that they would like to work or do research in a STEM discipline are very similar in the two groups. We proposed the question about the choice of a scientific career also to students attending the last year of high school but not taking part to the Masterclass, to increase the number of available “no” answers. This study cannot be considered as conclusive, but would rather like to provide a basis for discussion. There are still open questions that the scientific community should try to answer to interrupt that general pattern that, all around Europe, seems to reject female students from STEM disciplines while naturally bringing male students towards them.

References

- [1] <http://physicsmasterclasses.org/>
- [2] <http://www.pi.infn.it/leone/mc/mc2016/>
- [3] S. Leone, *The Masterclass of particle physics and scientific careers from the point of view of male and female students*, PoS (ICHEP2016) 319.