

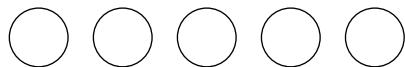
PERSPECTIVES

ResearchGate

Interview

A creative approach: How fab labs can help close the STEM gender gap

February 11, 2022



Worldwide, less than 30% of researchers are women, according to UNESCO. Though studies show that girls perform as well—or even better—than their male counterparts in math and science subjects at school, they are far less likely to study science or math in university or subsequently enter STEM-related careers.

Research has shown many reasons for the gender gap, including social perceptions of STEM subjects as more “masculine” and discrimination against women at the academic level.

So how can the STEM gender gap be addressed? Some advocates think achieving a gender balance may require a creative approach. As manager of the nonprofit De Creatieve STEM, mathematician Maria-Cristina Ciocci tries to make STEM accessible for all by engaging a network of fab labs (digital fabrication laboratories) throughout Belgium. Last year, she and her lab colleagues helped develop and organize three STEM bootcamps for the EU-funded Girls In STEM project.

For the International Day of Women and Girls in Science, ResearchGate's Elyse Franko-Filipasic chatted with Maria-Cristina and her colleague Lennard Ameys about the bootcamps, their careers, and their vision for engaging women in STEM.



Maria-Cristina (second from left) and Lennard (center) in the maker space with their colleagues.

Elyse Franko-Filipasic (EFF): Can you introduce yourselves and tell us a bit about your work?

Maria-Cristina Ciocci (MCC): I am a mathematician, and was actually working in academia for almost 20 years. About 10 years ago, I started a kind of small robot club with my children, just as a hobby. And now we have our own fablab (the Ingegno Maker Space), and it's grown into a nonprofit association with six employees. We try to promote science and technology for everybody. I switched over to doing this full-time two years ago.

Lennard Ameys (LA): I studied industrial design and then I did an internship here in the lab. And then I stayed on after my internship. I studied to become a teacher as well, so now my main job is to give workshops to children, as well as some classes to adults, to learn about digital fabrication. I work here in the lab and help develop everything

and help people use machines and those kinds of things. I also worked on the Girls in STEM project — I developed the toolkits we used in the bootcamps, and I went to the bootcamps to guide the participants through the process.

EFF: What was the motivation for starting the Girls in STEM project? How did you get involved?

LA: We wanted to attract girls to STEM fields, to show them that STEM is for everybody. During the bootcamp they saw that it's not difficult, and that we can help them develop the skills they need to work in the sciences.



Maria-Cristina works with a Girls in STEM bootcamp participant.

EFF: How old were the girls and women at the camps and where did they come from?

MCC: The camps were a collaboration of four countries: Belgium, France, Poland, and Spain. So every country brought four to six girls to each of the camps, and we tried to encourage them to interact with each other and learn to work together. They ranged in age from 16 to

EFF: Could you walk me through the course of the camps? What kinds of activities did the girls participate in?

LA: So the camp in Spain focused on reverse engineering. We used 3-D scanning AR technology, and also worked with clay to model some things. The girls learned how to develop a smoke machine from a hairdryer — so we took a hairdryer apart and used some parts of it to make a smoke machine, that was a really fun one to make. The participants could see that the technology is actually really simple on the inside. Then they also learned to communicate with each other using technical terms, and to use technology like soldering stations, 3-D printers, laser cutting and 2-D modeling during that week.

MCC: There were three camps [covering reverse engineering, digital art, and wearable technology]. Each camp was a mixture of community making and engaging with technical topics. So with the reverse engineering camp, for instance, they started by just discovering what reverse engineering is, what you can do with it, and then learning some in-depth techniques. The goal was always to create something at the end using digital fabrication techniques.



Bootcamp participants test their converted hairdryer smoke machines.

EFF: Cristina, was your work on these camps inspired at all by challenges you've faced in your own career?

MCC: I think I'm not quite a typical story as a woman in STEM. I am from Italy, which is still quite a male-dominated country, but when I started studying mathematics, there were a lot of women on the faculty at my university. It was only when I got to Belgium for my PhD that I ended up in a very male-dominated environment. I mean, I went to a conference where I was the only woman among 300 people! And I began to notice that I really had to make an effort to find other women in the same field. Ultimately, you don't want to be judged based on your gender, or on your appearance, but on your value to the scientific community.

And then as I got older and had a family, I started noticing another divergence between men and women: the women are often expected to do more of the work with the family. As an academic, you have to be prepared to go abroad, to do your postdoc wherever your career brings you. My husband is also a scientist, so we actually had an agreement that if one of us got a good opportunity to do research abroad, we would work together to make sure we could do that — whether or not we had a family. And in our case, this actually meant that I was the one who went abroad to England when I got a Marie Curie grant. And my husband stayed in Belgium with our 10-month-old twin daughters. So yes, in my work now, I'm driven to create equal opportunities for girls.

EFF: Why do you think the gender gap in STEM is still so present?

MCC: I really think it starts with education. Parents — mothers and fathers — are the first people to put stereotypes in the heads of children. We start at an early age to differentiate girls and boys, to buy toys and clothes based on their gender. And sometimes we forget to look at the children as individuals, to see what they are really interested in. For example, when my daughters were little, we wanted to buy them toys and clothes with science themes...outer space, insects. But you couldn't get space-themed pajamas in the girls' department. So

we always shopped for our daughters in the boys' department.

There are a lot of parents — a lot of people in general — who think this gender issue is not an issue anymore. It's something they think disappeared in the 1950s or the 1980s. But it's still there, it's just not as visible. And this can end up having real consequences, like fewer women choosing science for their jobs because there are so few female role models in STEM.

EFF: Judging by the numbers, Europe is doing relatively well in terms of women working in STEM — they make up 40% of the STEM workforce.

MCC: Well, the numbers may seem to be better in Europe. Sixty percent men to 40% women seems like a pretty good ratio, right? But there is still a long way to go before we achieve equality. First, there is still a big imbalance in academic positions. The top positions are still mostly men, and it's very difficult to change this. Often, women end up leaving the academic track and get other kinds of jobs, and they are more likely to stagnate in their careers — the glass ceiling is still a problem.

And I think the best way we can change this is to improve education and start addressing gender stereotypes early on. School can play a big role, books can play a big role. Even toy makers — for example, why should Legos be made in "boy colors" and "girl colors"? These things should stay gender-neutral.



EFF: I'd like to know more about your nonprofit, De Creatieve STEM. What kinds of programs do you run and who are they targeted toward?

MCC: We actually have two big projects within the Flemish part of Belgium. One is called [FabZero](#), and it is a training program for makers. So if you are creative or an aspiring maker, this is a very intensive training program that you can compare with the [International Fab Academy](#) [which teaches skills for digital fabrication and rapid prototyping]. And it was actually set up to prepare people to participate in the International Fab Academy courses. FabZero is now in its third year, and it's going really well. We have a really wide network — last year we had 60 people complete the intensive training, but we had almost 5000 people participate in FabZero programs altogether.

And now we also have another big program where we try to help libraries create STEM content, so you can have a makerspace in the library. We don't want it to feel like an external thing, we want the makerspace to be built into the fabric of the library and empower the librarians to run STEM-related activities in the library. So we are trying to train them not only from a didactic point of view, but also technically — we want them to work with the machines and understand how they can work with the public and these machines.



Through De Creatieve STEM, Maria-Cristina shows kids the fun of working in science.

EFF: I have to admit, when I think of librarians, I don't necessarily think of people who are well versed in STEM topics. Does it require a lot of training on your part? And why the focus on libraries?

MCC: Libraries aren't just a place for books. They are a place where people go to meet each other, and in the recent past were the only place many people could use computers, or use the internet. So now, we are trying to create entry-level makerspaces in the libraries. And yes, it does require some training in technology, like in using 3-D printers, and cutting with plotters.

And at least in Belgium, just about everyone goes to a library at least once in his or her life. So our idea is that if there's a makerspace in the library and if people can come into contact just once with these concepts, then the librarian can identify this interest and give a bit of an explanation and demonstration. Librarians take the role of an educator and basic facilitator. The mission of the library is to share knowledge and that's similar to the mission of makers.

And lastly, being in a library is great because it's a neutral space. People

— and especially girls — are sometimes intimidated by this idea of going into any kind of lab. In general, fab labs are still male dominated. So there are stereotypes of the kinds of people who work in labs, but libraries are really for everyone. So we think that putting a basic makerspace in the library can help create a more neutral first point of contact and inspire more interest in STEM, and then help direct people (and especially women) to other fab labs in the area.

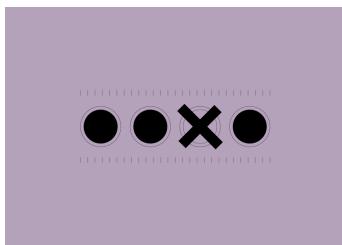
Want to see what Maria-Cristina and Lennard are building now? Check out Ingegno Maker Space on Facebook and Instagram.

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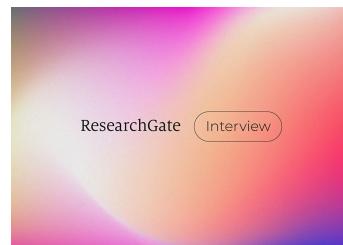
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