Interview with Prof. Laura Capelli

As part of the Erasmus plus project NO GENDER GAP we asked Prof. Laura Capelli to tell us about the gender gap in the Italian school with respect to the results in scientific subjects of female students compared to those of male colleagues.

Prof. Capelli taught mathematics and was the Scientific Education Referent of the Regional School Office of Liguria.

The interview was conducted by Stefania Operto, School of Robotics.

> *Periodically, or at each OECD-PISA Report, there is the problem of a lower representation of women in techno-scientific professions, and especially the data on the lower success of female students in mathematics. What are your analyses and experiences in school?*
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> *Are female students less good or less autonomous?*
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> *How much do the cultural environment and the influence of the family influence?*
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> *What do you think about the assessments of some Authors who believe that the assessment tests - and perhaps the whole school/university programme. are affected by non-neutral bias?*

Laura Capelli.

This is a subject that interests me very much. I dealt with it first as a teacher and then at the Regional School Office of Liguria.

Learning about science subjects, and in particular mathematics, has always presented discriminatory aspects in terms of learning assessments both at national and international level.

I will not go into the past because it would be a long discourse, but the fact remains that, to date, in everything that is in the national evaluation systems in most OECD countries, what has been found is that girls are better in the humanities and boys in science.

This is an incredibly discriminatory aspect that has very distant roots: even if it seems a contradiction, with the Gentile Law women were not allowed to participate in competitions to teach humanities in high schools because they were thought not to be able to do so. Instead, they could enrol in scientific faculties because these studies were considered second class faculties. This, however, brought them great work difficulties because women were not employed in jobs that were reserved for men, I think engineering or mathematics.

This discrimination which, on the contrary, actually seems to affect today precisely the learning of mathematics and science because in Italy - I am now referring to Italy - is affected by the Gentile law which we have been carrying around for so many years and which sees those scientific subjects as second-class subjects. Italians now have the habit of saying “I don’t understand anything about mathematics”.

And from then on, a whole series of prejudices have spread about scientific subjects that affected students’ enrolment figures.

Compared to the problem of girls’ lower skills, what we see in the national trials is that males actually do better. There are different schools of thought on this.

There are schools of thought that say that boys are actually more - pass me the term I do not share - led towards science subjects; but there are also more significant observations that I have also found in studies made in the United States that underline two aspects: the first refers to the tests that students are subjected to, in particular the Pisa tests, in which all OECD countries also participate. These are tests that involve 15-year-old students on the basic skills of mathematics and language, now there are also other skills that are assessed that are financial competence and creative thinking. The tests collect information about what they can become as active citizens. Every Ministry of Economy invests, also in Italy, on these tests and the results are then shared. The Pisa tests are quite articulated and contextualised tests in which the variables or the paths to the solution are clearly not evident.

In these tests Italy presents a gap between learning and result that is very strong in mathematics and in Italian: the females are much better in Italian and much less good in mathematics. The opposite is the case in Finland, but it should be noted that schools in Finland train - pass me the term - students to do the tests Pisa while in Italy there is no such culture.

This gap is not reflected in the school performance of girls who often do much better in mathematics than boys, and so one wonders why they fail in the Pisa tests.

There are two observations: the first is that the Pisa tests were actually written, built for a male imagination. I always take this example: a Pisa test concerned the circuit of a racing car, the shape of the circuit on the test and a speed/time graph were represented and students were asked, among other questions, which were the points where the acceleration was higher. This text was presented by a teacher to his class (I clarify that there are many PISA tests that teachers can access and present to the class to prepare them for the tests, they are not the tests that will be released because those remain encrypted, but they are tests that are in line with the others) and one of his students answered immediately by simply

looking at the circuit. The teacher asked how he was able to respond exactly in such a short time and o student said “Well I do motocross bikes and when I go on a track so I know exactly where I have to accelerate”.
This is an example of a test that is better suited to a male imaginary and there are many other tests that are parameterised on learning standards more related to the world of males than females.
There is another observation to make: females are generally much more competitive at school than males in most cases because they want to achieve their goals. For this reason, they adapt to the model of teacher they have. If the teacher they have proposes a repetitive model, very *scholastic,* girls become very good following that model. This tendency to adapt leads them to lose a little bit of autonomy of thought, which the males do not lose because they are more negligent, more disinterested and think more about what they want to do rather than what they are told to do. This is a bit the limit that girls sometimes have.
In the United States what is observed is that in schools attended by rich whites girls are more interested in humanities while in schools attended by a school population belonging to less well-to-do classes, the following happens the opposite. Another aspect that struck me: in American public schools, those for wealthy classes, are often for all-female or all-male or mixed schools. In all-female schools girls are much better at mathematics in both national and international tests, while in mixed classes they are not, which suggests that there is still a tendency for teachers to think that the male is the one who has to deal more with science subjects and the female is the one who has to deal more with the humanities.
There are also other theories - that the girls are more suited to the humanities simply because of their sensitivity, which I do not share. I think instead that a lot of work should be done on the construction of the items, because in my opinion the design on the male imaginary weighs a lot and above all we should also work on the construction of a critical thought at school and make the girls who unfortunately have a bit of an adaptive tendency try to be independent and do not adapt to the models that are proposed to them.
This is a cultural heritage that comes from the situation of women since the beginning.

Operto: For what is your experience there is also a family influence that discourages girls from science subjects?
Laura Capelli.

When I started teaching yes, today I have to say that the situation has changed a lot because the orientation is all projected according to the work that girls and boys can do. In this case it depends on the types of schools. In vocational colleges there are male or female students who are oriented to work because they belong to a class that is not well-off or socially disadvantaged. In high schools there is no such problem and today there is more freedom of choice.
In Italy we are behind other countries because of the legacy of the Gentile reform. Something is starting to change, for example they have opened courses in management engineering that we say attract more females.

Operto. Do you remember a particular case from your experience as a teacher?
Laura Capelli. At one time I had combined mathematics with the study of drawing and art history so I captured a lot of girls and I have to say that girls who had very low grades motivating them in a little bit more transversal directions had excellent results.

Operto. What could be done to bring girls closer to science subjects? What could be done more and better?
Laura Capelli
A more effective bridge between school and university should be created so that girls who leave school accustomed to working with school methods can then find a way and bring their talents to university. There is in fact a very strong discontinuity between the language used in high school and that used at university. I insist on working on international evidence which, beyond the stereotypes, still gives interesting information about trends in OECD countries.
We should analyse why in some countries the results are better for girls and change the teaching methodology a bit. In the 1980s there was a lot of work on teaching methodology and there were high schools and technical institutes in Milan which were very advanced. Later this work got a bit lost, and we went back to quite standardised teaching clichés, linked to technicalities. Perhaps more work should be done on methodology and motivation.

Operto. According to you, in the face of an increase in the range of instruments we can use today, there has been a sort of flattening on thought, on the method?

Laura Capelli.

We have a world full of tools and we could do a lot of things. The problem is that we are not aligned either with external reality or with the tools we have and this has led to a flattening. From the old National Computer Science Plan of the 90s in then there was nothing that pushed in that direction. Girls and boys live in an outside world very different from what they find at school and this slows down and flattens education. The result is that the girls align themselves on this flattening with the results because we see: in the international tests the boy's study less but maybe because of what I said they get more.

Operto. Is there a difference between the regions?

Laura Capelli

In the Invalsi tests there are excellences in north-eastern Italy and heavy falls in the south. But the situation is more complex and the distinction is not so clear-cut. The fact is that the schools in the north-east belong to a rich productive fabric and therefore it is easier to have higher cultural levels. What has been observed is that although the cultural level in the South is lower, cultural growth is more evident in the South than in the North, i.e. the South starts at lower levels but reaches a good level faster, in the North they are at levels
and they do not progress. This is something Invalsi has been working on, also calculating the growth of the various results in the various areas.

Another element is motivation: in professional studies Invalsi results are lower than in scientific high schools, but in the former teachers have a greater ability to motivate students and the growth in professionals is sometimes more evident than in science high schools.

Operto. The new generations, the last one in particular born with IT tools .
Do you think it will be different or is there no correlation between the availability of wearable smartphones and mathematics, the one you study at school?

Laura Capelli.

I'm very optimistic about this last generation, 15-16-17 year olds, I find them very evolved, they can accept adults and often understand them. If there was more vertical communication between adults and children, I think we would get good results.

Thank you, Prof. Capelli, do you have a case, an anecdote in conclusion?

Laura Capelli.

I often talk to students about a great mathematician, Evariste Galois, who discovered some incredible things that were then re-evaluated in the early twentieth century. Galois died at the age of 18 to defend a lady in a brothel. He left his writings and the mathematicians of the time did not understand them and they were re-evaluated at the beginning of the 20th century.

Galois at the age of 17.18 already knew how to write about mathematics in an extraordinary way. In a high school where I taught, we dedicated a classroom to Evariste Galois.