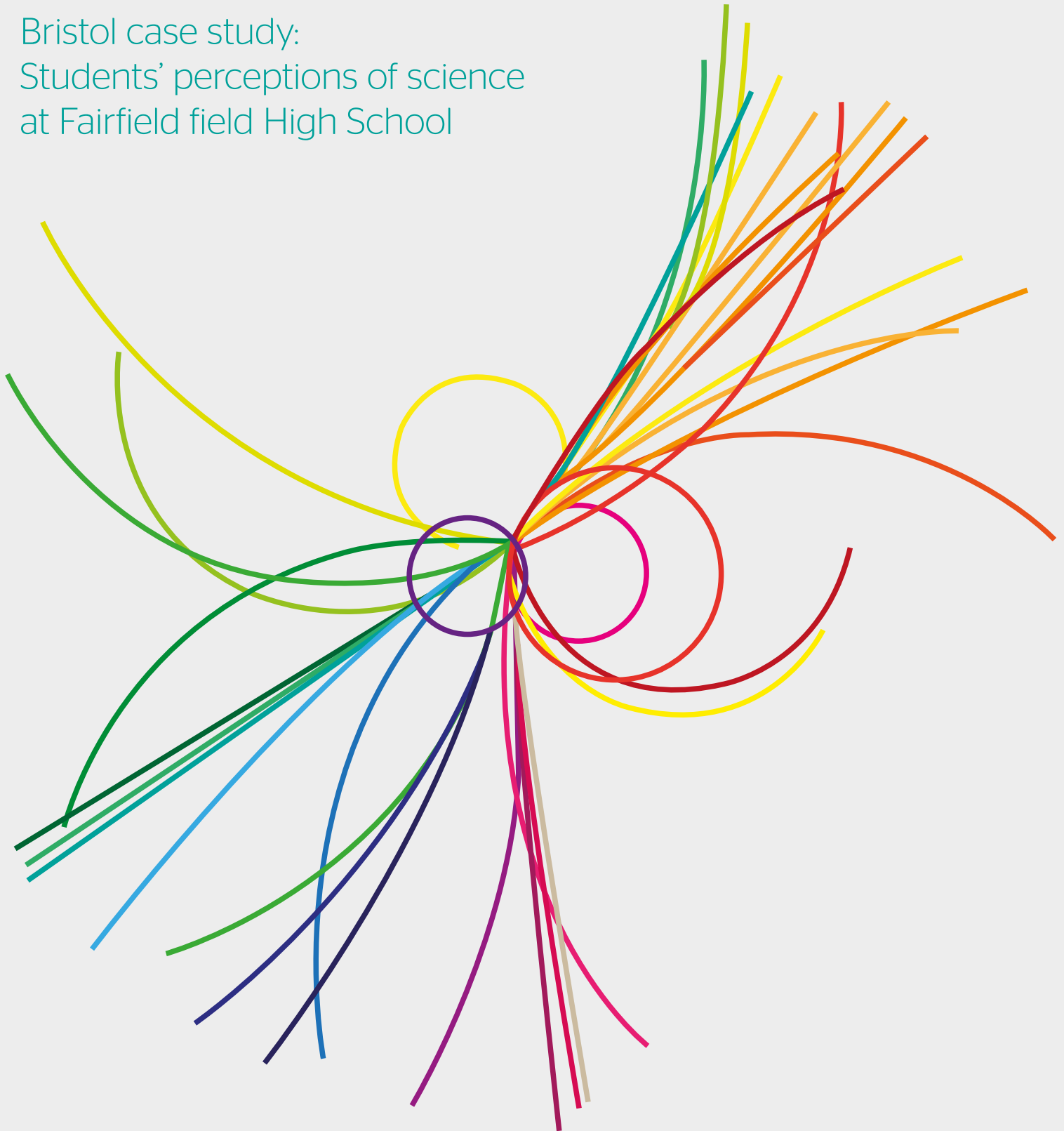


PERFORM PROJECT

Return of preliminary results

Bristol case study:
Students' perceptions of science
at Fairfield field High School



This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under No 665826 grant agreement



The Art of Science Learning

This report presents the preliminary results of the PERFORM project conducted at your school, relating to **students' general perceptions and attitudes towards science and learning science**. Results are based on students' answers to the written surveys delivered before and after the implementation of the workshops. The surveys were answered by 19 students (7 girls and 12 boys) who attended the workshops. We also received answers from a group of 13 students (5 boys and 8 girls) who did not participate in the project, in order to have a control group against which to compare the PERFORM students' answers.

For most of the survey items, we applied a Likert scale measuring students' degree of agreement to different statements (from 1, meaning 'strongly disagree', to 7, meaning 'strongly agree' and 4 being 'neutral'). The figures included in this report show the answers from the PERFORM group and represent these degrees of agreement through different colours, ranging from red (for disagreement) to green (for agreement) and using blue for neutral answers.

We have only included the responses of students who answered both pre- and post-surveys, so as to compare changes before and after their participation in the workshops. During our analysis, we also compared answers between the PERFORM and control group and explored potential sex-related associations, using logistic regressions. Only in the cases in which we found a statistically significant association between students' answers and any of these two variables, we have included the corresponding graph showing results (that is showing answers per sex -girl/boy, or per group - PERFORM/Control). Due to the small sample size, results from these statistical analyses showing significant associations should be taken with caution.

Results in this report are presented as follows. First, we explore students' general perceptions towards science and their understandings of the role of science in and for society. We then explore students' perceptions relating to gender in science. Finally, we approach students' personal values related to science, their feelings while doing science-related activities and their motivations for studying scientific careers.

Highlights

- 1** STEM related subjects were perceived by students as enjoyable ways to acquire new knowledge, with **science and design technology being the most preferred and mathematics the least enjoyable**. Learning about IT and computing was more enjoyable for boys than for girls.
- 2** Students in general **perceived science education activities positively and reported feeling comfortable** when doing them. **Girls felt less comfortable than boys before workshops**, a difference that was not found after the workshops, **suggesting that workshops could have reduced such a gender gap**.
- 3** The majority of students **perceived that science is related to real-life problems and could help them understand global issues**. Boys **agreed more with such perceptions than girls**.
- 4** Students also perceived that **scientific jobs are important for having a better society and disagreed that men are better scientists than women** and that **scientific jobs are mostly for boys**. Students participating in the workshops perceived the **research profession as more gender balanced** than their peers in the control group.
- 5** In general **students did not have a clear idea about their future studies**. Around half of them **perceived learning science as important for their future success, science classes as helpful to get a job and would like to study a STEM related career**.
- 6** **Boys perceived learning science as more helpful to get a job than girls**, a difference that was not found after workshops. But workshops did not have an impact on reducing the gender gap in this regard since **boys were more willing to study a STEM career than girls both before and after the workshops**.
- 7** Around half of the students saw themselves doing science in the future. **Boys agreed more with this idea than girls**.

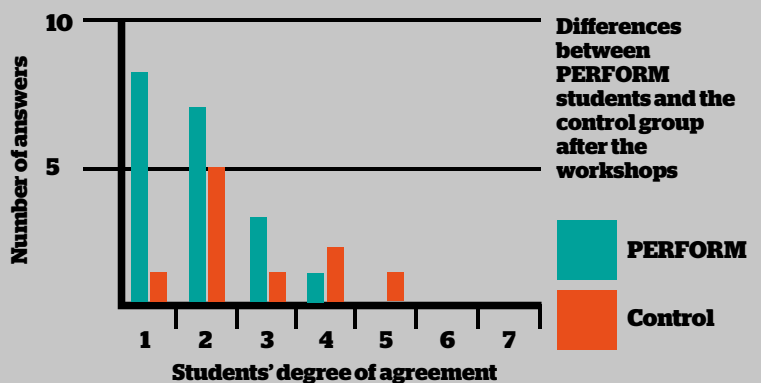
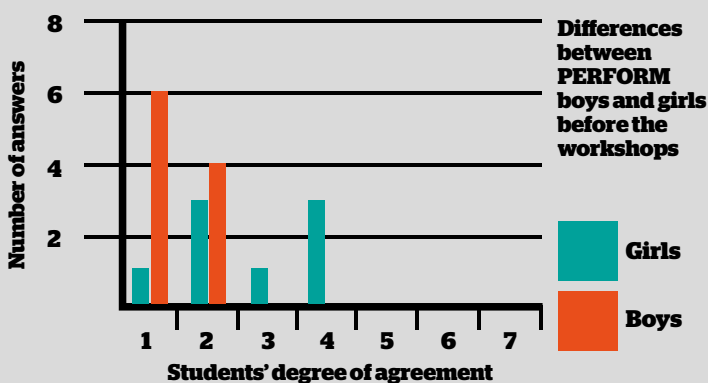
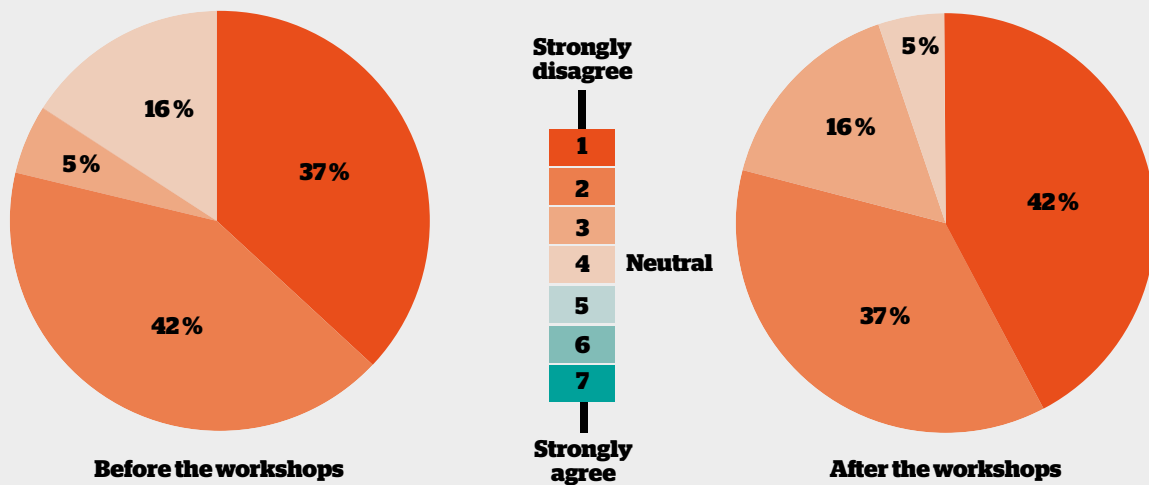
Results description

Students were asked in the survey about their perceptions of the **role of science in and for society**. In general, **those participating in workshops already had positive perceptions towards science** before the workshops, which remained almost unchanged after the workshops. **However, such perception did seem to be strengthened in comparison to the control groups**. Interestingly, **workshops also seemed to have a gender-related impact in this regard**.

The majority of students disagreed that science had nothing to do with real-life problems, both in the pre-survey (16) and the post-survey (18). After participating in the workshops, 2 students changed their opinion from a neutral view to a view supporting the idea that science was linked to real-life problems, but no statistically significant differences were found on this subject. By contrast, **there was a statistically significant difference between boys and girls before the workshops: boys disagreed more that science is not related to real-life problems than girls** (see Figure below). This significant difference was not found after the workshops, suggesting that girls might have changed their perception after participating in the workshops.

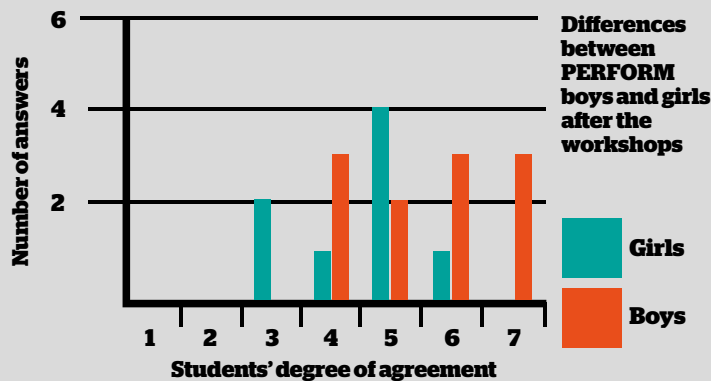
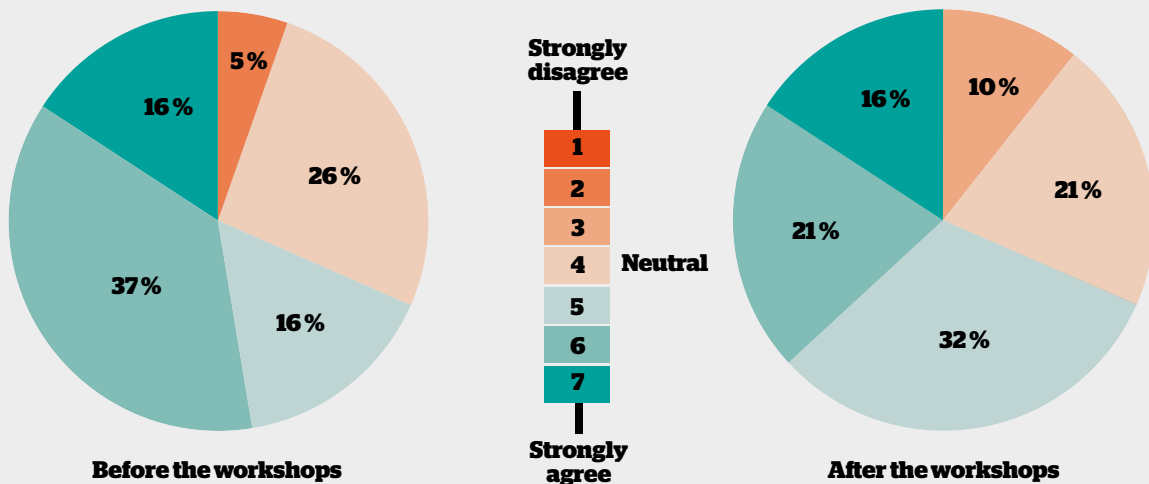
Also, students' involvement in the workshops seemed to have an effect on their perceptions since in the post-survey significant differences were found between PERFORM students and those from the control group: **PERFORM students disagreed more with the statement that science has nothing to do with real-life problems than the control group** (see bar-graph below).

“Science has nothing to do with real-life problems”



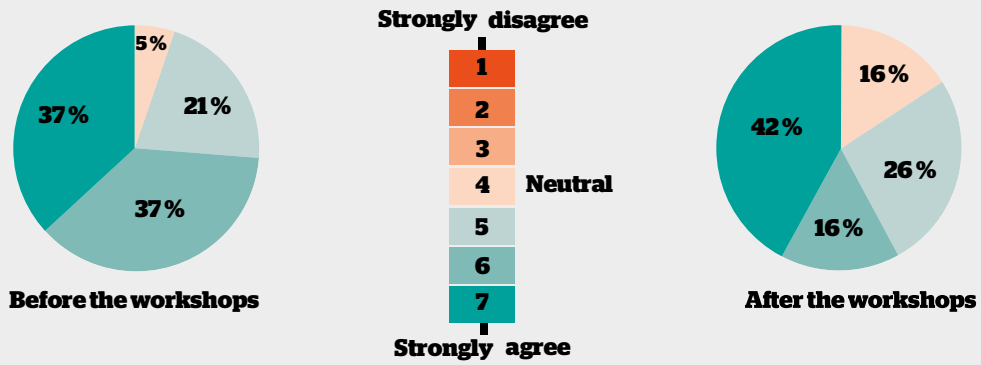
This general perception about the connection of science with societal challenges was also supported by **students' responses to the question "science will help me understand more about worldwide problems" since most of them agreed with it in the pre- and post-surveys** (13 out of 19 students). Although not statistically significant, the number of students who thought that science could not improve their understanding of worldwide problems increased from 1 to 2 after the workshops and those giving neutral answers decreased from 5 to 4. There were not significant differences between PERFORM students and the control group. Interestingly, and similarly to the previous statement, we found significant differences in relation to gender: **after the workshops, more boys agreed more that science could help them understand worldwide problems than girls** (see bar-graph below).

"Science will help me understand more about worldwide problems"



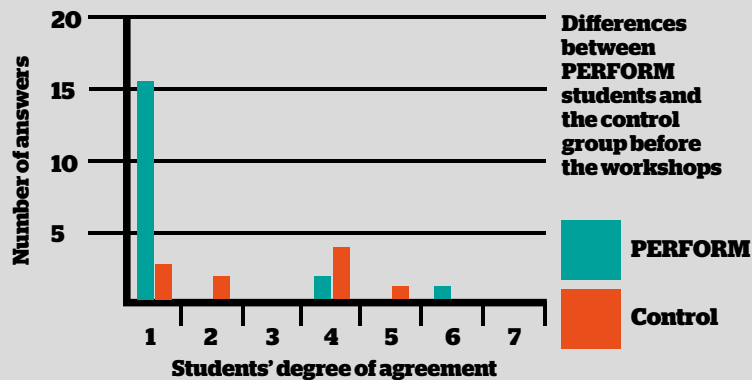
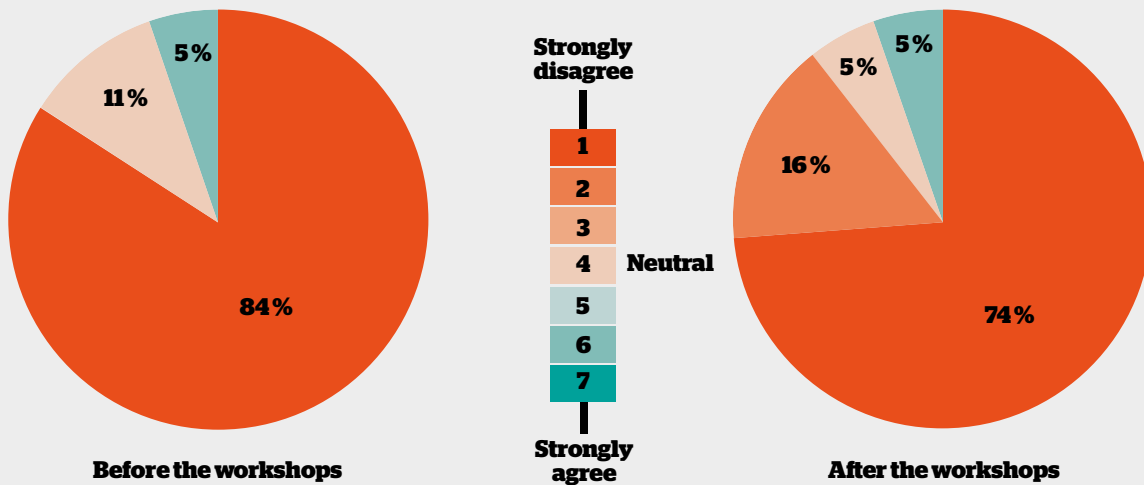
Also, relating to the students' perceptions of the role of science in and for society, **overall both girls and boys perceived that scientific jobs are important for a better society both before and after the workshops** (18 and 16 students). Although two girls changed their opinion from positive to neutral responses in the post-survey, there were not statistically significant differences between girls and boys, nor in students' responses in the pre- and post-surveys.

“Scientific jobs are important for a better society”



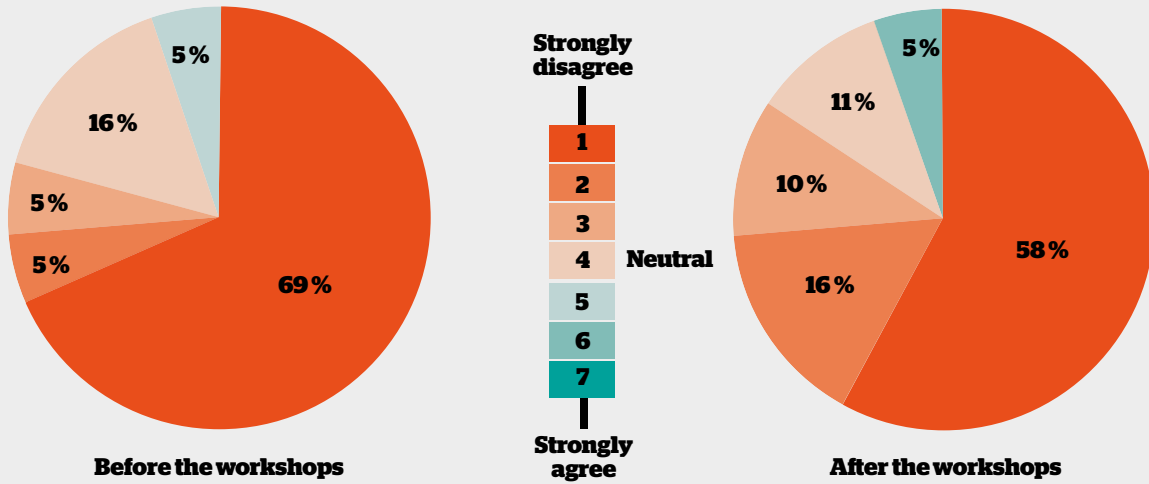
Students also answered questions about their **perceptions of gender-related roles in science**. **Overall, students disagreed that men are better scientists than women both before and after the workshops** (16 and 17 students respectively). One of the students who provided a neutral answer in the pre-survey changed his opinion and disagreed with the statement afterwards. Only one boy perceived that men are better scientists than women both before and after the workshops. **Significant differences were only found between PERFORM and control students before the workshops, with PERFORM students being more in disagreement with the statement than those in the control group**, which suggests that students participating in the workshops perceived the research profession as more gender-balanced than their peers.

“Men are better scientists than women”



Similarly, most students disagreed that scientific careers are mostly for boys: 15 and 16 students before and after the workshops. Again, only one boy agreed with it. No significant differences were found between groups.

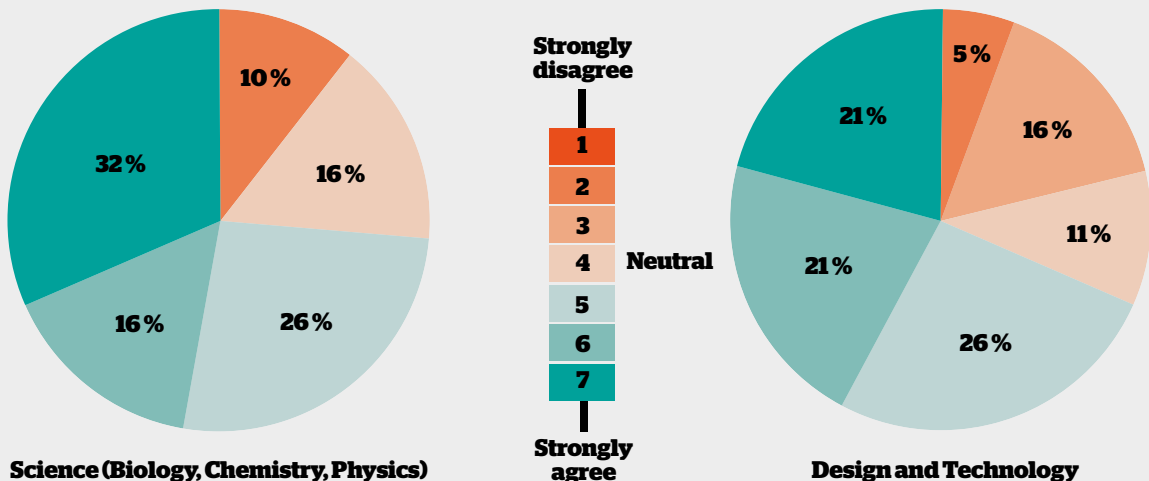
“Scientific careers are mostly for boys”

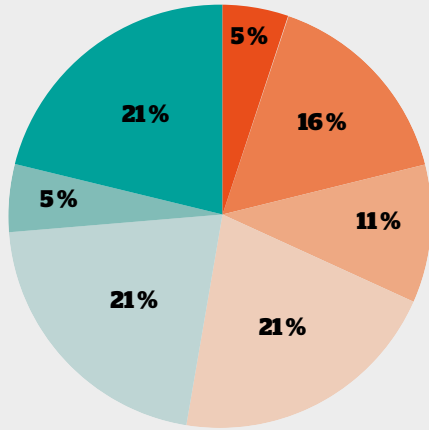


We also explored **students’ feelings about science learning at school**, through items about their enjoyment of science subjects and the emotional experience of science.

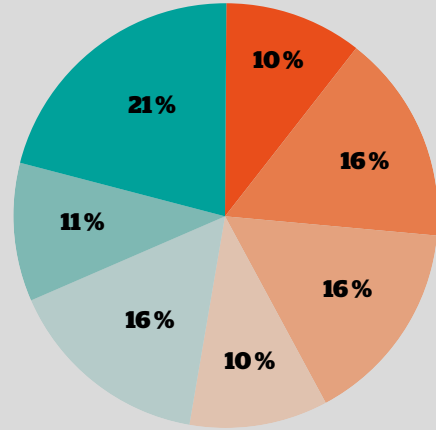
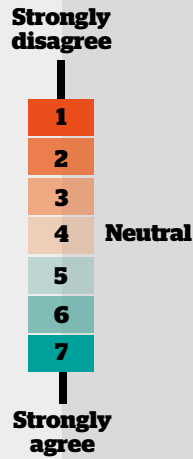
Overall, **PERFORM students perceived STEM related subjects at school as enjoyable ways to acquire new knowledge**, and specifically **those subjects related to science and design technology**. Most of the students (14) responded that they did enjoy learning science (biology, chemistry and physics) and only 2 that they did not, while 13 students indicated they did enjoy learning design and technology and 3 that they did not. Regarding IT (information technologies) and computing, 9 students reported enjoying acquiring new knowledge in this subject and 6 that they did not. There were statistically **significant gender-related differences, as boys enjoyed learning IT more than girls**. In turn, **students’ perceptions regarding learning mathematics were split**: 9 students answered they liked learning mathematics whereas 8 students said they did not. Significant differences were found in this regard between PERFORM and control groups: **students in the control group enjoyed learning mathematics more than those attending workshops**.

“I enjoy acquiring new knowledge in...”

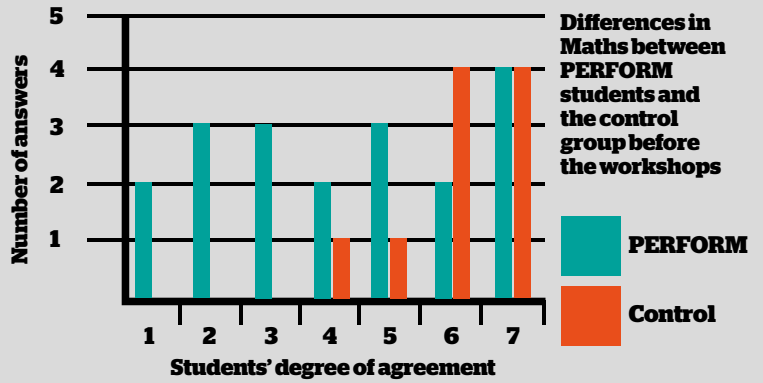
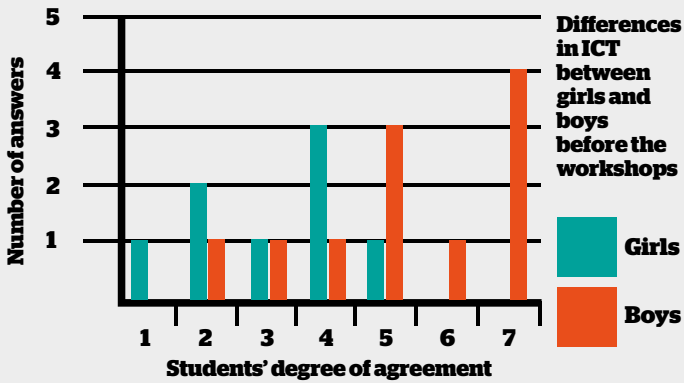




ICT/Computing

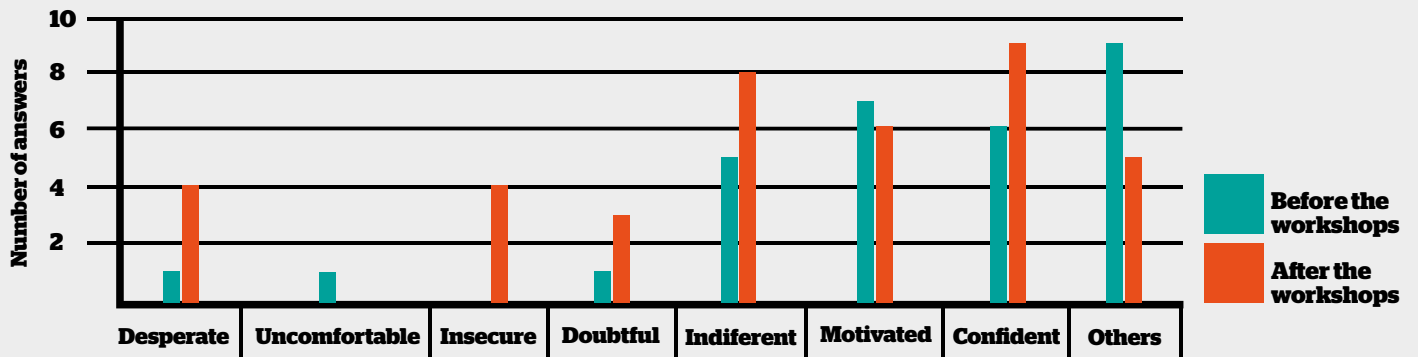


Maths



When asked **how they felt in a science class or while doing science-related activities** in the pre-survey, most students answered they felt “motivated” (7 students), “confident” (6) and “indifferent” (5) whereas afterwards they felt more “confident” (9) and “indifferent” (8) but also “less motivated” (6). The number of students showing feelings related to “insecurity” and “desperation” increased after the workshops from 0 to 4 students and from 1 to 4, respectively.

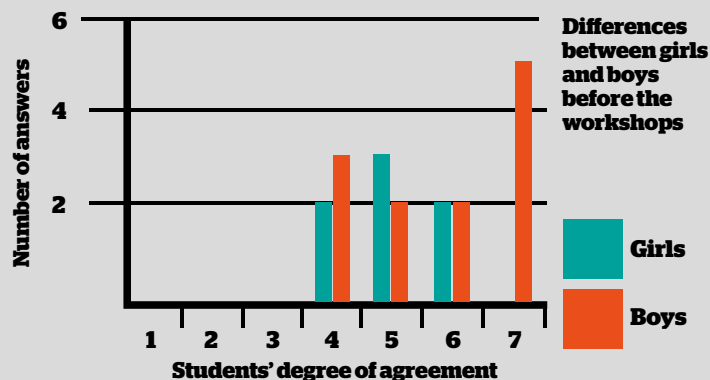
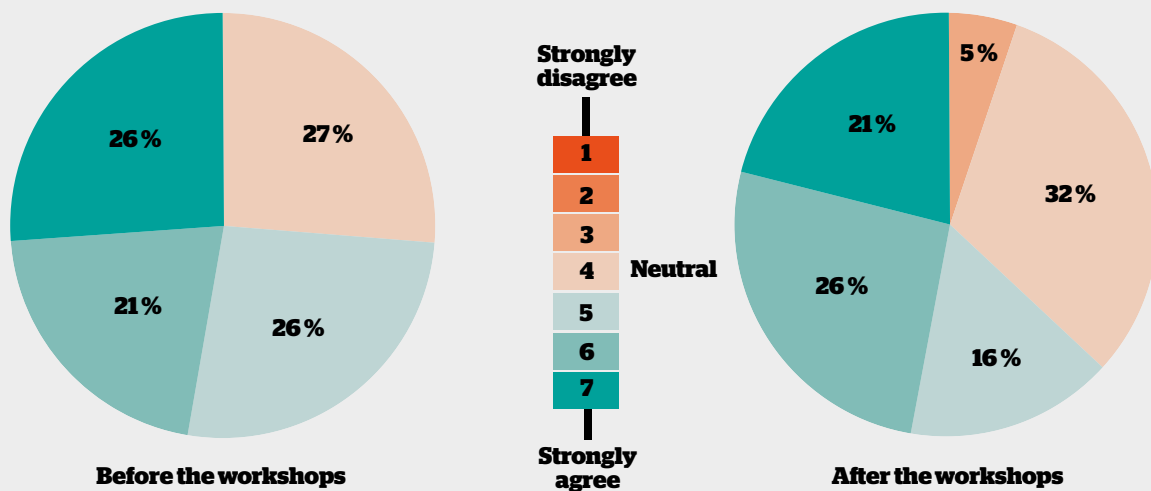
“In a science class or while doing science-related activities, I usually feel...”



However, statistical tests showed no significant changes before and after, nor between students from PERFORM and control groups. Therefore, **workshops did not seem to have a significant effect on students' positive or negative feelings towards science education activities, which were in general positive.** But interestingly, **workshops could have had an impact on girls in this regard.** When specifically asked if they felt **comfortable while doing activities related to science in the pre-survey, a statistically significant higher proportion of girls felt less comfortable than boys** (see figure below). After the workshops this significant difference was not found, **suggesting that workshops could have reduced such gender gap.**

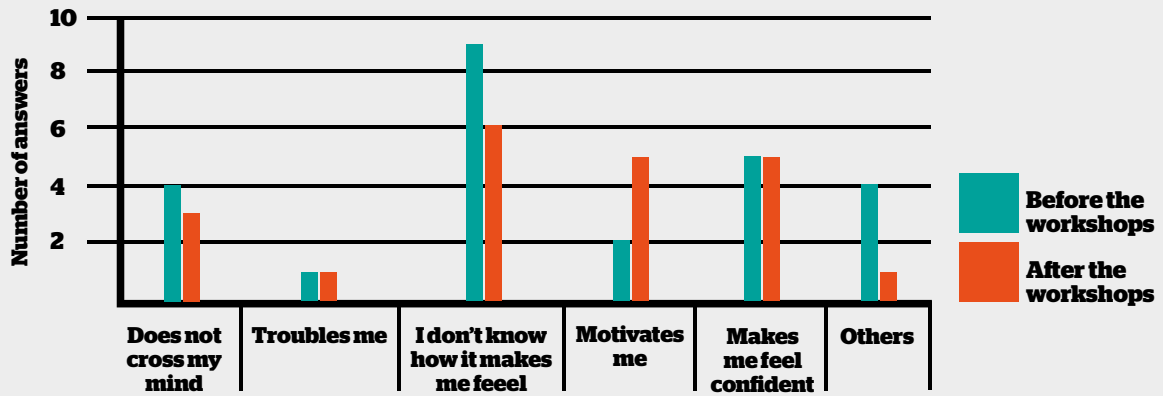
In general, students felt comfortable when doing science-related activities before and after workshops (14 and 12 students respectively). No significant differences existed between students attending workshops and those from the control group, either before or after.

“I feel comfortable while doing activities or tasks related to science”



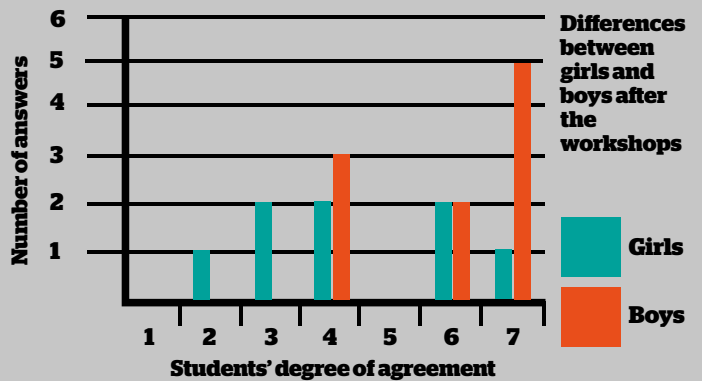
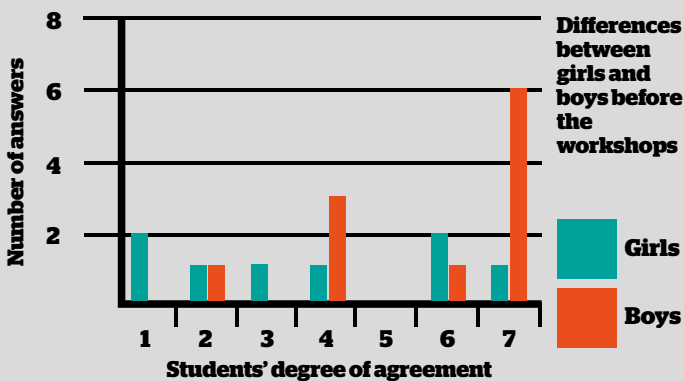
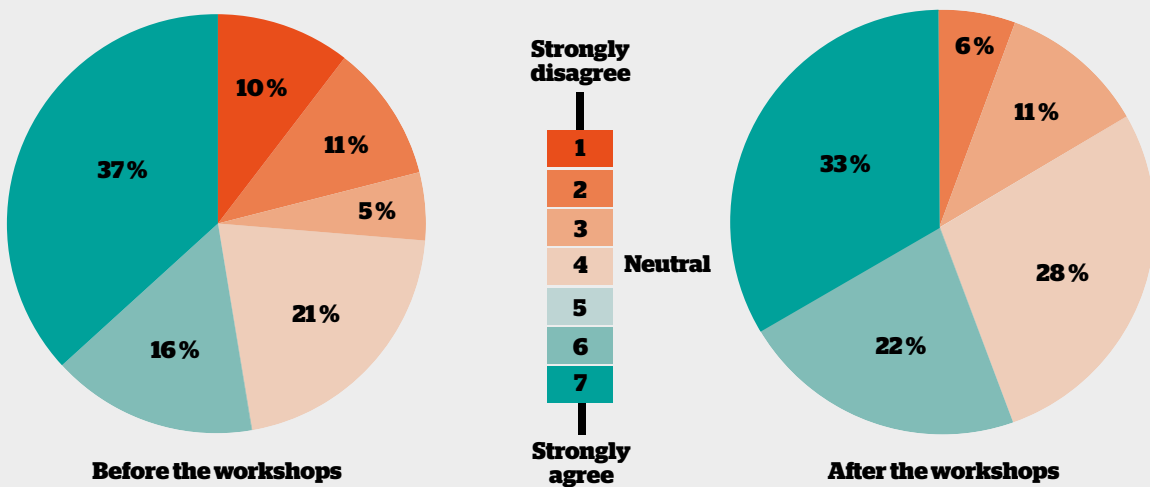
Finally, **students were asked about their motivations for learning science and studying scientific careers. In general students did not have a clear idea about their future studies before the workshops** since almost half of them (9) answered they did not know how thinking about studying a scientific career made them feel. This number was reduced to 6 students after the workshop. Also, the **idea of studying a scientific career was more motivating for a slightly higher number of students after having participated in the workshops** (5 students) than before (2 students), but there were not statistically significant differences in this regard. 5 students responded they felt confident when thinking about studying a scientific career both before and after the workshops.

“The idea of studying a scientific career...”



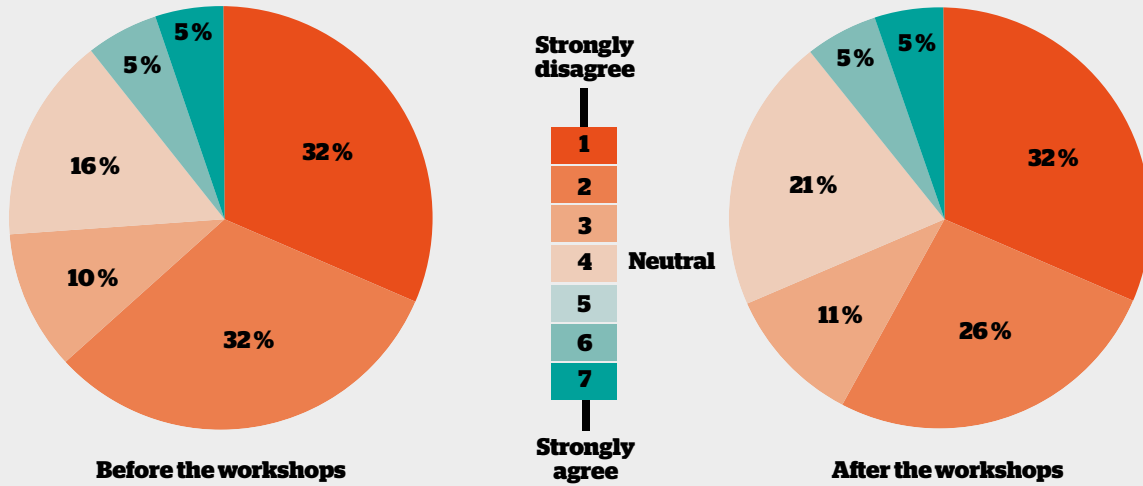
Around half of the students (10 out of 19 students) responded in the pre- and post-survey that they would like to study a STEM related career. Boys were more willing to study a STEM career than girls, as statistically significant differences related to gender were found in students’ answers to the pre-survey and post-survey. No significant differences were found before and after the workshops, which suggests that **workshops did not have an impact on students’ willingness to study a STEM career, and specifically in reducing the gender gap.**

“I would like to study a career involving science (like biology, geology, physics, medicine or chemistry), technology, engineering or mathematics”



Despite these results, **students did value learning science as relevant for their future success with 2 exceptions, who agreed with the statement “Learning science is not important for my future success”**. Statistical tests did not show significant differences between boys and girls on how they value learning science. Answers given by these students also did not differ from the control group, in both surveys (pre- and post-).

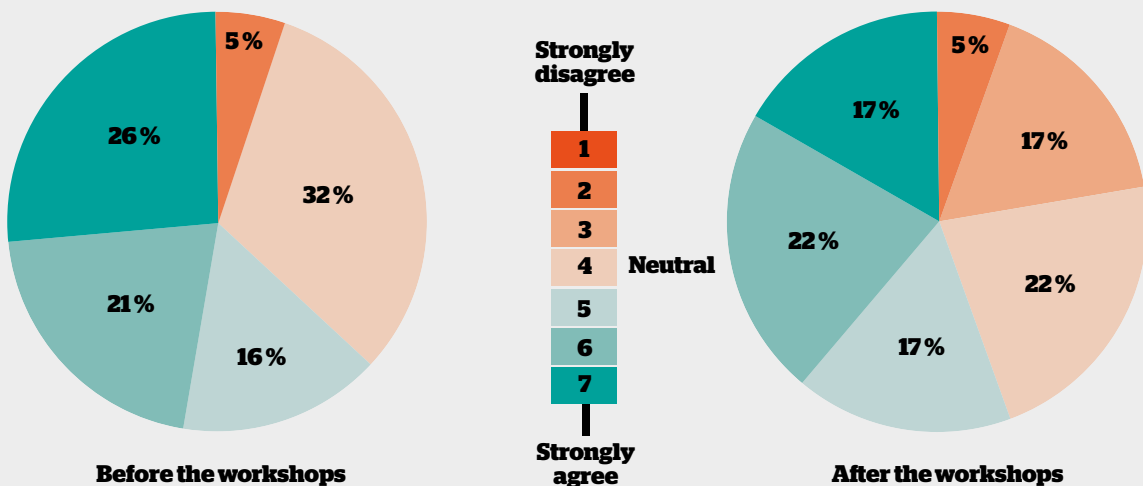
“Learning science is not important for my future success”



When reacting to the statement **“What I learn in science class will help me to get a job”**, significant differences did exist between boys and girls before the workshops, with a higher number of boys providing positive answers than girls (see figure below). These gender differences were not found in the post-survey, which suggests that **workshops might have reduced this gender gap**.

However, the overall number of students who agreed that what they learn in science class would help them to get a job slightly decreased after the workshops (from 12 to 10 students). Also, a higher number of students gave negative answers in the post survey (1 student before and 4 after). These differences were not statistically significant.

“What I learn in science class will help me to get a job”



Similar results were found when asked **if they could see themselves doing science in the future**: 11 and 10 students agreed with the statement before and after the workshops respectively. The number of students providing neutral answers largely increased from 2 to 7 students, suggesting that some of these students (mostly girls) could have slightly reduced their disinterest in science due to their participation in the workshops, although significant differences were not found in this regard. We did find **significant differences between boys and girls, with girls providing more negative answers than boys** both before and after the workshops, which suggests the need to keep working with a gender perspective in science education.

“I can see myself doing science in the future”

