The European Science Fairs Evaluation Framework – pilot study

An Intel & EUN initiative.

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EXECUTIVE SUMMARY

In this report we present and analyse the data obtained from the pilot evaluation of four European science fairs. The aim of the evaluation exercise was to show the data that can be obtained from the evaluation tool developed. The evaluation tool is planned to be administered in all Intel-affiliated fairs and provide useful data for analysis, ensuring cross-country and cross-year comparability.

The students’ and teachers’ data from the four fairs were combined and are provided in table or graph format in separate sections, with short descriptions and highlights for each graph. As a helping simple tool, average statistical profiles of participating students and teachers are provided at the end of each data section. These statistical profiles can be as comprehensive as is required.

At the end of the report, a more detailed analysis of the students’ and teachers’ data is presented together with some conclusions, while the data for each fair is provided in a separate report per fair.

Main findings from students

• They are newcomers (but loyalty effect).
• Male predominance.
• Gender differences in the project areas, with males’ interest split between science and technology & engineering, while women focus mainly on science.
• A balance between individual and team projects.
• Hard work (high degree of student commitment to the projects).
• Greater confidence in identifying problems, finding solutions and how to use the scientific method or even had fun in the fair.
• Improvement in communicating and team skills (students find many values in participation).
• Difficulties in getting hold of materials and equipment, as well as carrying out the different steps in the scientific method (facing and overcoming these difficulties results in “an increase in confidence”).

• Internships for 20% of the participants (a further show of commitment).
• Essential factors for success: creativity and communication skills, followed by intelligence. Collaboration and leadership came in last.
• Gender effect in personal traits: intelligence is the one skill where there was a larger than 15% gender difference.
• Voluntary participation for 80% students. They were equally influenced by the teacher(s). (Big teacher influence.)
• Satisfaction for 90% of the participants. (This makes the fairs an educational success.)

Main findings from teachers

• Slight gender (female) predominance.
• Long teaching experience, over 10 years for 36% and over 20 years for 40%.
• Repeat school participation for 66% of the schools. (Good receptivity of the fairs among schools).
• Even higher teacher repetition: not the first fair for 75% of them. (This may be due to teachers’ permanence in a given school).
• Large students/teacher ratio: 75% bring up to 10. (High teacher commitment with the fairs).
• Teachers’ areas: Science (38%), next Engineering (19%). (The figures correlate with the topics in the students’ projects).
• Supervised projects are predominant in Science; Technology and Engineering are similar. (Varied character of the schools activities).
• Out-of-school activities for 50% of the students. They are not in 21% schools. (Students make extra efforts to participate in these fairs).
• Voluntary tutoring for 99% of the teachers and a school coordinator exists in 60% schools. (This indicates a felt need as well as a guarantee of success).
Executive summary

- The project clearly linked with the national STEM curriculum in 40% of the cases. (So, either the projects have a broader aim than the curriculum, or it is not easy to develop sufficiently interesting projects by keeping inside the curriculum boundaries).

- School support for participation in the fair in 75% of the cases. 55% support from colleagues, parents and experts. Least support comes from local authorities, local media or even the National Ministry of Education. (Those items require more effort from the fair and school management).

- Most useful support comes from mentors or science experts as well as the school management (60 and 46%, respectively).

- Students’ personal traits for success are creativity, communication skills and intelligence (50%). Collaboration, scientific literacy and work ethic are considered only in 25% of the answers. The capacity of leadership was not considered. (It would be interesting to analyse these results in more detail in the future).

- Main reason for teachers’ commitment: “My students” (94%) and prestige (74%). Less important: the prospect of promotion (29%), and the effects of their colleagues (43%). (These answers may help in designing future announcements and rules for the development of fairs).

- Inquiry-based methodology changes from 25% to 35%. For 2/3 of the participating teachers the use of IBSME (Inquiry-Based Science and Mathematics Education) is still an unknown factor in the teaching equation. (Thus the Science Fair initiative helps to improving school education as regards the necessary transformation and updating of teachers’ methodologies, so that the students’ education is improved in terms of transferable knowledge, skills and competences).

- 86% of the teachers are satisfied and would repeat tutoring. (This is a remarkable result of the whole programme and, in conjunction with students’ opinions, one may conclude that both for teachers and students, participating in the science fairs is an enjoyable and positive educational experience).

Overall the key messages are that 70% of the students that participate in science fairs are afterwards more likely to consider studying a STEM degree; 65% of the students after participating in a science fair are more likely to consider a STEM career and more than 80% of the teachers considered they had learnt a lot through participating in the science fair, thus finding science fairs an effective way of obtaining professional development.
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INTRODUCTION
In this report we present and analyse the data obtained from the pilot evaluation of four European Science Fairs. The aim of the evaluation exercise was to show the data that can be obtained from the evaluation tool developed. The evaluation tool is planned to be administered in all science fairs affiliated to the Intel International Science and Engineering Fairs (Intel ISEF) and provide useful data for analysis, ensuring cross-country and cross-year comparability.


Here we just provide the minimum information required to be able to follow the rest of the report. The data contained in the students’ and teachers’ questionnaires are listed in two separate sections in graph or tabular form, followed by a detailed analysis and conclusions. The full contents of the students’ and teachers’ questionnaires are given in an appendix.
EVALUATION
METHODOLOGY
The evaluation of the science fairs was focused on three aspects in relation to two target groups: students and science teachers. The three main aspects of the fairs that were evaluated are impact, support and sustainability. The aims were the following:

- **Impact** – The effect of participating in science fairs on students and teachers.

- **Support** – The help received for participating in science fairs (students) or for tutoring students’ science projects (teachers).

- **Sustainability** – The motivation of students and teachers to participate in science fairs.

We explored those three aspects by developing two questionnaires (one for teachers and a separate one for students, see Appendix) to be filled in by the participants at the five selected science fairs.
The items in both questionnaires (for students and teachers) are divided into separate sections in order to obtain information about the various items of interest, as shown in Table 1.

**TABLE 1: ASPECTS EVALUATED IN EACH SECTION OF THE STUDENTS’ (SQ) AND TEACHERS’ (TQ) QUESTIONNAIRES.**

<table>
<thead>
<tr>
<th>SECTION</th>
<th>ITEMS IN...</th>
<th>TO OBTAIN DATA ON THE...</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SQ</td>
<td>TQ</td>
</tr>
<tr>
<td>1</td>
<td>1-7</td>
<td>1-10</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Demographic data</strong> and other basic characteristics of participants.</td>
</tr>
<tr>
<td>2</td>
<td>16-20</td>
<td>22-27</td>
</tr>
<tr>
<td></td>
<td>8-9</td>
<td>11-12</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Impact</strong> of science fairs on the participants.</td>
</tr>
<tr>
<td>3</td>
<td>10-13</td>
<td>13-17</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Support</strong> received by the participants.</td>
</tr>
<tr>
<td>4</td>
<td>14-15</td>
<td>18-21</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Sustainability</strong> and motivation of participants in the science fair.</td>
</tr>
</tbody>
</table>

The questionnaire items mentioned in Section 1 provide the usual demographic data that serve the purpose of characterizing the sample of students and teachers who participated in the five science fairs that have been evaluated.

The particular components investigated in Section 2 (Impact) of the student questionnaire include students’ (self-assessed) knowledge, skills and attitude towards science, their learning experience, and their motivation to study science and choose a career in science. Section 2 in the teachers’ questionnaire additionally contains questions regarding the educational value of their student’s participation, and the impact that the science fair had on their school and on their teaching practice.

Section 3 (Support) aims to identify problematic or challenging aspects (e.g. funding, access to materials and equipment) of those participating in science fairs from the point of view of both students and teachers; and how and by whom they were supported to overcome them.

Section 4 (Sustainability) focuses on the motivating and discouraging (intrinsic and extrinsic) factors for students and teachers to participate in science fairs. The teachers’ questionnaire also contains items on inquiry-based teaching and the possible role that science fairs may play in promoting it.

The questions contained in the teachers’ and students’ questionnaires are presented in unambiguous, jargon-free statements with a Flesch-Kincaid readability. Grade level is 7.3 for the students’ questionnaire, suitable for Grades 7 - 8 (i.e. 12 - 14 years old), and 8.4 for the teachers’ questionnaire. Additionally, except in the case of the few open-ended questions included, all the questions had a limited range of answers, either in the form of a Likert-type scale, as a multiple-choice or as a single-choice question. We shall give a few more details about the Likert scales and their analysis in the following section. In some items, respondents could add additional comments or explanatory remarks to their answers.
LIKERT SCALES AND STATISTICAL ANALYSIS
As mentioned above we have used various 4-level Likert scales to rate the various options provided in some answers, see column 1 in Table 2. However, the difference between respondents saying “completely agree” or just “agree” is highly influenced by personality traits and the differences signify little in terms of statistics. Therefore for the analysis of data levels 1+2 and 3+4 have been combined and redefined as Low and High degree of fulfilment, respectively (see Table 2, column 2, Redefined scale A), or, whenever more appropriate, as No and Yes, respectively (see Table 2 column 3, Redefined scale B).

<table>
<thead>
<tr>
<th>LIKERT SCALE</th>
<th>REDEFINED SCALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - Not at all / Very difficult</td>
<td>Low No</td>
</tr>
<tr>
<td>2 -</td>
<td></td>
</tr>
<tr>
<td>3 -</td>
<td>High Yes</td>
</tr>
<tr>
<td>4 - Completely agree</td>
<td></td>
</tr>
</tbody>
</table>

Concerning the statistical analysis of the questionnaire data, and as a general comment on the data to be discussed in this report, let us mention that due to the intrinsic accuracy of the data obtained from the questionnaires, which is roughly within the ± 10% range, we shall only single out gender differences or other differences in any of the items contained in the students’ and teachers’ questionnaires when these differences are larger than about 15%.
OVERALL RESULTS
OVERALL RESULTS

The respondents of the questionnaires were participants – students and their teachers (tutors) – at the selected science fairs. In total, 129 teachers and 464 students completed the questionnaires. The breakdown per science fair is indicated in Table 3.

<table>
<thead>
<tr>
<th>NAME OF EVENT</th>
<th>LOCATION</th>
<th>STUDENTS</th>
<th>TEACHERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concurso Jovens Cientistas e Investigadores</td>
<td>Portugal</td>
<td>114</td>
<td>37</td>
</tr>
<tr>
<td>The International Environment &amp; Sustainability Olympiad (INESPO)</td>
<td>Netherlands</td>
<td>78</td>
<td>2</td>
</tr>
<tr>
<td>Ifjúsági tudományos és innovációs tehetségkutató verseny</td>
<td>Hungary</td>
<td>51</td>
<td>16</td>
</tr>
<tr>
<td>Středoškolská odborná činnost</td>
<td>Czech Republic</td>
<td>221</td>
<td>74</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>464</strong></td>
<td><strong>129</strong></td>
<td></td>
</tr>
</tbody>
</table>

The events in Portugal and the Czech Republic were national events, while the event in the Netherlands was international. The Hungarian event, while national, included Hungarian expat communities living in other countries like Serbia. Throughout the remaining of the report, we will refer to the events by the country where they were hosted, regardless of the nationality of the participants.
STUDENTS’ QUESTIONNAIRES
The 464 students who filled in the science fairs student’s questionnaire were mostly between 15 and 20 years of age, with an average age of over 17 years. Figure 1. A split of ~40% women versus 60% men is also observed (see Figure 2).

**Figure 1: Age of respondents (students).**

**Figure 2: Gender split among the respondents (students).**
Although most students were newcomers (72% of the participants were participating in the respective fair for the first time) a significant 10% had been to three or more of these fairs (Figure 3).

Science and Technology were the most common topics of the participants’ projects (~80%, see Figure 4) with Maths being less than 5%. Still, science topics predominate by a factor of three over technology projects and a factor of almost four over engineering projects.

When the data in the previous figure are discriminated by gender, we find that females favour science topics over technology or engineering topics by a factor of 10 to 1 (see Figure 5) whereas males only do 68% more scientific than technological projects, and 47% more technological than engineering projects.

* The missing/above % in figures where the total should be 100%, is result of rounding the figures.
The following shows the ratio of the project topics discriminated by gender.

**TABLE 4: RATIO OF SCIENTIFIC TO TECHNOLOGICAL TO ENGINEERING TO MATHS PROJECTS BY GENDER AND AVERAGE.**

<table>
<thead>
<tr>
<th>GENDER</th>
<th>RATIO OF SCIENCE</th>
<th>TO TECHNOLOGY</th>
<th>TO ENGINEERING</th>
<th>TO MATHS PROJECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>1.7</td>
<td>1.5</td>
<td>3.2</td>
<td>1</td>
</tr>
<tr>
<td>Females</td>
<td>10.1</td>
<td>1</td>
<td>2.5</td>
<td>1</td>
</tr>
<tr>
<td>Average</td>
<td>3.1</td>
<td>1.4</td>
<td>2.8</td>
<td>1</td>
</tr>
</tbody>
</table>

The overall participation in the events appears to be split equally between individual projects and team projects, Figure 6.

**Figure 6: Individual versus team participation in the fair (students).**

Analysing the next three figures together: over 80% of the participants took several months to develop the project (Figure 7), while the presentation part took a time that varied between a few hours, for 17%, and a week for 37% (Figure 8). More than half of the participants attended after-school science activities (Figure 9).

**Figure 7: Time spent on developing the project (students)**.

* The missing/above % in figures where the total should be 100%, is result of rounding the figures.
In Figure 10 we show the percentage of students who agreed with different statements on the effect of the science fairs on themselves. The full statements are:

8.1. Now, I am more confident at identifying problems.
8.2. Now, I am able to communicate better.
8.3. Now, I am better at team work.
8.4. Now, I am better at finding solutions or coming up with new ideas.
8.5. I had fun competing in the science fair.
8.6. I learnt a lot through competing in the science fair.
8.7. Now, I know more about the scientific method.
8.8. Now, I am more excited about science.
8.9. Now, I can see better how science is relevant to my everyday life.
8.10. Now, I am more likely to consider studying a scientific subject.
8.11. Now, I am more attracted to the prospect of a scientific career.

Figure 10: Agreement with different statements (students).
A high percentage, over 80%, reported an increase in confidence in identifying problems, finding solutions and knowing more about how to use the scientific method, or even had fun participating in the fair. A slightly smaller percentage of the students, about 60%, have improved in team-working capabilities or felt more likely to study a STEM degree (around 65%).

In Figure 11 we show the percentage of students who selected each of the statements as advantages of carrying out a science fair project. The main advantages selected (based on more than 50% responses) were the possibility of working on a project of their own (64%), and having a chance to work with people outside the school walls (58%). The most important factor is the chance to show their work to society at large (78%).

The fact that no marks are involved in developing a project is only relevant for 14% of the students. Very few students (below a few %) checked the “I do not know” or “None of these” options.

We see in Figure 12 that, on the other hand, around 48% found it difficult to get hold of materials and equipment needed for the project. At a similar level of difficulty for the students (40-50%) came working with the various components of the scientific method (formulating and testing hypotheses, analysing data, etc.). The relatively least difficult part was to choose a topic to work on for the project (36%).
In Table 5 we show the percentage of students who found the knowledge and experience received from different sources useful. We have highlighted in green those percentages higher than 50%. The Internet proves to be the most successful resource, followed by the teacher and mentors in the field. Family members come in 4th place. About 50% find school classes useful. Advice from previous fair participants and after-school science clubs are important for a third of the students.

### TABLE 5: USEFULNESS OF VARIOUS SOURCES OF PROJECT SUPPORT (STUDENTS).

<table>
<thead>
<tr>
<th>Source</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.1 Teacher(s)</td>
<td>77%</td>
</tr>
<tr>
<td>11.2 Mentor / Expert in the field</td>
<td>75%</td>
</tr>
<tr>
<td>11.3 After school science club / programme</td>
<td>32%</td>
</tr>
<tr>
<td>11.4 School classes</td>
<td>48%</td>
</tr>
<tr>
<td>11.5 Former science fair participants from your school</td>
<td>34%</td>
</tr>
<tr>
<td>11.6 Internet / Online support (webpages, chats, forums)</td>
<td>85%</td>
</tr>
<tr>
<td>11.7 Family members</td>
<td>54%</td>
</tr>
</tbody>
</table>

Only 20% of the participants participated on average in an internship related to the project (see Figure 13).

![Figure 13: Participation in internships related to the project (students).](image)

As seen in Table 6, over 60% of the students felt creativity was the most essential factor, followed by communication skills (58%). The third skill would be intelligence (42%). Collaboration (11%) and leadership (7%) came in last. Scientific literacy was placed at the same level (about 23%) as work ethic.
TABLE 6: MOST ESSENTIAL CONTRIBUTIONS TO THE PROJECT’S SUCCESS (STUDENTS).

<table>
<thead>
<tr>
<th></th>
<th>OVERALL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intelligence</td>
<td>42%</td>
</tr>
<tr>
<td>Work ethic</td>
<td>24%</td>
</tr>
<tr>
<td>Critical thinking</td>
<td>37%</td>
</tr>
<tr>
<td>Communication skills</td>
<td>58%</td>
</tr>
<tr>
<td>Scientific literacy</td>
<td>22%</td>
</tr>
<tr>
<td>Curiosity</td>
<td>32%</td>
</tr>
<tr>
<td>Creativity</td>
<td>61%</td>
</tr>
<tr>
<td>Collaboration</td>
<td>11%</td>
</tr>
<tr>
<td>Leadership</td>
<td>7%</td>
</tr>
</tbody>
</table>

When discriminated by gender, the data in the previous table show that intelligence proved to be the only skill where there was a larger than 15% difference in responses between genders. 50% of the male students consider it an essential skill, compared to 32% of the women.

Overall 80% of the students carried out the science projects on a voluntary basis, without the school forcing them (Figure 14) but almost 80% were influenced by the teacher(s), as seen in Figure 15).

Figure 14: Is it compulsory in the school to do a science fair project? (students).

Furthermore, according to Figure 15, additional factors that influence the participation of students in these projects are the opportunity to do something science-related that is different from what is done in school (77%) and the prestige or recognition from competing in the fair (78%), as well as the opportunity to improve one’s application to university (78%).

The influence of friends participating in the fair ranks at only 30%. It is followed by parents’ influence, which is stressed in 50% of the cases.
Finally, almost 90% of the participants wish to repeat and recommend the experience to a friend (Figure 16).

Only around 10% would not participate in a science fair event again in the future.
Conclusion: Average students' profile

Taking into account only the major characteristics indicated in the students’ replies to the questionnaires, one finds the average picture depicted in Figure 17. This provides a simple helping tool which contains the average statistical profiles of participating students.

Figure 17: Average participant profile (students).

The diagram above can be easily expanded to make it as comprehensive as desired, by including the most salient answers to other items in the questionnaires. In this way, cross-year, cross-country and cross-fair comparisons are quite easy to make.
TEACHERS’ QUESTIONNAIRES
The analysis of the questionnaires filled in by the teachers participating in the five science fairs that are reported on here shows the following results:

First, female teachers predominate slightly, Figure 18, and they have a long teaching experience, over 10 years for 36% of them and over 20 years for 40%. Only 5% have less than 5 years’ teaching experience (Figure 19).

Figure 18: Gender split among participants (teachers).

Figure 19: Years of teaching experience (teachers)*.

* The missing/above % in figures where the total should be 100%, is result of rounding the figures.
Teachers are also well qualified, with almost 75% holding a master's degree, Figure 20. There is even a significant 8% of PhD holders.

Figure 20: Highest degree held (teachers).

More than 66% of the participating teachers work in schools that have participated in more than three science fairs, Figure 21, and for only about 20% of the schools is this their first fair.

Figure 21: Number of school participations in the fair (teachers)*.

Almost 50% of the teachers are accompanying between 1 and 4 students, Figure 22, while a total of 75% bring up to 10. A quarter of the teachers are bringing in between 11 and 50 students.

Figure 22: Number of students from their schools who are competing (teachers).

* The missing/above % in figures where the total should be 100%, is result of rounding the figures.
We see in Figure 23 that for more than 75% of the teachers this was not their first experience with a science fair.

![Figure 23: First time participants in fairs (Yes) versus repeat participants (No) (teachers).](image)

According to Figure 24 the largest group are Science teachers, at 38%, and the next numerous group teaches Engineering (19%) while Technology comes third at 12%. Maths teachers account for 6%.

![Figure 24: Main subject taught (teachers)*.](image)

According to the accompanying teachers, Figure 25, the ratio of Science to Technology to Engineering projects presented is 2.25 : 1.1 : 1. Maths projects are just a few (1%). An important 25% of the teachers are accompanying projects from a combination of the areas mentioned above.

![Figure 25: Main focus of the projects supervised (teachers).](image)

*The missing/above % in figures where the total should be 100%, is result of rounding the figures.*
Around 45% of the students participated in after-school activities, according to the teachers, Figure 26, while over 25% did not and in 21% of the cases these extracurricular options were not available in their schools.

![Figure 26: Schools where the students participated in after-school science clubs, etc. (teachers).](image)

It is not compulsory for teachers in a given school to participate in a fair project in 99% of the cases, Figure 27, and the school designates a coordinator in 60% of the cases.

![Figure 27: Schools where 8) it is compulsory to participate in science fairs and 9) there is a person in charge of the participation (teachers).](image)

There is a clear link between the national STEM curriculum and the contents of the fair projects in more than 40% of the cases, Figure 28.

![Figure 28: It was easy to integrate the competition with the curricula (teachers).](image)
The teachers were also asked to rate various aspects of students’ participation in the fair. According to Figure 29 for more than 90% of the teachers their students learnt a lot from participating and know more about the scientific method. On the other hand, for about 53 to 60%, participation in the fair has had a big impact on the way they teach and rewarded their students for excellence in STEM.

11. To what extent do you agree or disagree with each of the following statements now that you and your students have participated in the science fair?

**Figure 29: Impact of participating in the science fairs on both teachers and students (teachers).**
The advantages of partaking in a science fair are, for the teachers, that they interact with their students differently (74%) and students are more motivated (69%), Figure 30. On the other hand, it is a good opportunity for collaboration across school years for 23%, and students start behaving like real scientists for 34% of the teachers.

12. In your opinion, what are the advantages of doing a science fair project over regular science classes?

![Figure 30: Advantages of doing a science fair project over a regular science class (teachers).]

The teachers may experience some difficulties in providing assistance to the participating students. The main problems are finding funding and getting students on board, or materials, and getting experts (about 60%), Figure 31, but supervising students in areas other than the teachers’ areas of expertise is a problem for just 26%. Only 4% of the teachers find difficulties in filling in application forms for the competition.

![Figure 31: Difficulties encountered in preparing a project and participating in the fair (teachers).]
The teachers also gave their opinion about what difficulties the students met in preparing the projects for the fair. In their opinion, Figure 32, on top of the same two items mentioned in the previous figure (finding funding and the materials for the project, both at about 55%), teachers add the difficulty for students to apply the scientific method (at 55%). The least difficulty lay in filling in the form to participate in the event (difficult for only 8%), followed by the difficulty for students to communicate their projects clearly (40%).

![Figure 32: Difficulties students found in activities in carrying out a project and participating in a fair (teachers).](image)

Now, concerning support for participation in the fair, the school provides support for almost 75% of the teachers, Figure 33, with support from colleagues, parents and experts coming second at about 55% average. Universities rank next at 42%. Least support comes from local authorities, local media or even the national Ministry of Education (all of them in the 15-22% range).

![Figure 33: Support obtained from different people or organizations (teachers).](image)
As regards the usefulness of the support, mentors or science experts as well as the school management were considered to be the most effective, with a big difference (60 and 46%, respectively), Figure 34. Colleagues and parents come next, at half the relative importance. The importance of other sources for support is below 5%.

A question looked into the personal traits of the participating students that, in the opinion of the accompanying teachers, contributed most to the success of the project undertaken. Teachers rank at about 50% or more creativity, communication skills and intelligence, in that order, Figure 35. Factors like collaboration, scientific literacy and work ethic are considered of less importance, selected in about 25% of the answers. Leadership is not considered at all.

It is important to know the reasons why teachers make the commitment to orient and even help students to participate in the fair. According to the data in Figure 36 “My students” stands out at 94%, and the prestige that comes from the competition (74%). Least importance is attributed to the prospect of promotion (29%) followed by the effect of their own colleagues (43%).
Pilot evaluation of Science Fairs in Europe

Teachers’ questionnaires

Figure 36: Factors or people that influenced the decision to lead participants in the fair and made the task easier (teachers).

Regarding the extent to which science fairs contribute towards extending the use of Inquiry-Based Science and Mathematics Education (IBSME), as Figure 37 shows, participation in science fairs results in a 7 percentage point increase in the use of inquiry-based teaching, since 28% of the teachers already use IBSME in their classes before attending the fair.

Figure 37: Use of IBSME before the science fair and afterwards (teachers).

It is a positive experience for the teachers to supervise students’ projects for the fair competition: 86% of them would do it again in the future, Figure 38.

Figure 38: Would you supervise a project for a science fair again? (teachers).
Regarding the data in Figure 39, asked whether they would be interested in becoming a Science Fair Ambassador, 42% agree, 26% do not, and 32% did not know yet at the time of the fair. The reasons for the negative answers were split equally between:

- I would like to try out other activities in the future.
- It took up too much of my time.
- I didn’t enjoy it as much as I thought I would.
- I received too little support.
- It involved too much paperwork.

![Figure 39: Interest in becoming a Science Fair Ambassador for their country (teachers).](image)

**Conclusion: Average teachers’ profile**

Taking into account only the major characteristics indicated in the teachers’ replies to the questionnaires, one finds the average picture depicted in Figure 40.

![Figure 40: Average participant profile (teachers).](image)
ANALYSIS AND CONCLUSIONS
The main conclusions of the previous overall analysis of the science fairs will be split in the following section into students’ and teachers’ results.

**Main students’ results**

**Newcomers:** Most students are first-timers at a fair (72%).
- A significant 10% had participated in three or more of these fairs.  
  ◦ This shows an important loyalty effect.

**Gender differences in the project areas:** Males focus on science and engineering & technology in equal measure.
- Females favour scientific projects over all other areas.
  ◦ This large difference deserves further investigation.

**Balance:** There is a good natural balance in participation between individual projects and team projects.
- This agrees with the spirit of the science fairs.

**Hard work:** The participants worked hard for the projects they presented.
- For over 80% it took several months to develop the project while the presentation part varied between a few hours and a week.
- And more than half of the participants attended after-school science activities.
  ◦ These figures show a high degree of student commitment to the projects, sustained over months, which is an evident educational and personal development value that originates from the science fair competition.

**Greater confidence:** Over 80% noticed an increase in confidence in identifying problems, finding solutions and using the scientific method or even had fun participating in the fair.
- A slightly smaller percentage of the students, about 60%, have improved in team-working capabilities or felt more likely to study a STEM degree (around 65%).
- It would be of interest to ascertain whether the missing 35% were initially convinced to do a STEM degree, or the work in the science fair project somehow discouraged them. In the first case, it may be that students are against studying a STEM degree or wanted to do it from the start, and participation in the science fair did not contribute to this (as they were already convinced initially). In the second case, i.e. someone who is interested in a STEM degree but after participating feels research is not for them and therefore they do not want to pursue a STEM degree anymore, it may be that they are not aware of other career options in STEM than research, a knowledge which is provided by EUN projects like inGenious, ideas from which might be considered for inclusion in the science fairs programme.

**Skills:** Having fun during the project and having improved their communication skills stand out as possible outcomes of participation in the programme.
- The most important factor is the chance to show their work to the society at large. Other advantages of carrying out a science fair project were the possibility of working on a project of their own and having a chance to work with people outside the school walls.
  ◦ This shows that students find many possible values in developing these projects and that gains other than scientific skills are also involved.

**Difficulties:** 40% of the students found it difficult to get hold of materials and equipment needed for the project and in carrying out the different steps in the scientific method.
- The relatively least difficult part was to choose a topic to work on.
- Applying the various components of the scientific method (formulating and testing hypothesis, analysing data, etc.) come at a similar level of difficulty to getting materials for the project.
  ◦ Obviously, facing and overcoming these difficulties results in ‘an increase in confidence [in] how to use the scientific method’.
  ◦ Maybe in future studies one might check how many failed attempts students have made, that is, whether the project developed was the one finally presented.

**Internships:** 20% of the participants on average took part in an internship related to the project.
- This fact reinforces the commitment factor mentioned above: students participate willingly and are motivated to spend time on the project for a period of months, without the need for a more formal link like an internship.

**Essential factors for success:** One of the most interesting results found was the items participants found essential to the success of their project. Over 60% of the participants felt creativity was the most essential factor, followed by communication skills.
  ◦ The third skill would be intelligence. Collaboration and leadership came in last. Scientific literacy came out at the same level (about 23%) as work ethic.
Analysis and conclusions

◊ Terms like leadership, collaboration and work ethic may not be typical ingredients of standard school education, and belong more to the standard workplace culture.

Gender effect in personal traits: When discriminated by gender, the data show that intelligence proved to be the only skill where there was a larger than 15% gender difference.
- 50% of the male students consider it an essential skill, compared to the 32% of women.
- This fact deserves further consideration.

Voluntary participation: Overall 80% of the students carried out the science projects on a voluntary basis.
- Almost 80% were influenced by the teacher(s).
- These results show the perhaps expected influence of teachers in orienting students’ activities, especially the extracurricular projects.

Satisfaction: Almost 90% of the participants wish to repeat and to recommend the experience to a friend.
- This makes the fairs an educational success.

Main teachers’ results

Slight gender predominance: Female teachers predominate slightly.
- Participants have a long teaching experience, above 10 years for 36% of them and over 20 years for 40%. Only 5% have less than 5 years’ teaching experience.
- Contrary to the students’ relative male predominance, female teachers are slightly more present than male counterparts.

Repeat school participation: More than 66% of the participating teachers work in schools that have participated in more than three science fairs.
- For only about 20% of the school is this their first fair.
- This demonstrates the good reception that the fairs meet with among schools.

Even higher teacher repetition: Teachers are on average more assiduous participants in the fairs than students: for more than for 75% of them this was not their first experience with the science fair.
- This is, of course, only natural as teachers stay in the school for more years.

Students/teacher: Teachers bring many students to the fair: almost 50% of them accompany between 1 and 4 students while a total of 75% bring up to 10.
- And a fourth of the teachers are bringing in between 11 and 50 students.
- The large ratio of students/teacher show high teacher commitment with the fairs.

Teachers’ areas: Most are Science teachers, at 38%, and the next numerous group teach Engineering (19%).
- Next come Technology (12%) and Maths (6%).
- These percentages correlate with the topics presented by the students.

Supervised projects: The ratio of Science to Technology to Engineering projects presented is 2.25 : 1.1 : 1.
- An important 25% of the teachers are accompanying projects from a combination of topics.
- This stresses the varied character of the schools’ activities, which promote projects in all possible fields.

Out-of-school activities: Almost 50% of the students participated in extracurricular activities, according to the teachers.
- Over 25% did not and in 21% of cases these extracurricular options were not available.
- The figures indicate that an important proportion of students make extra efforts to participate in these fairs, as we have already found in the students’ data. It would be interesting to check whether this proportion does indeed increase in the next years.

Voluntary tutoring and support, although it is not compulsory for teachers in a given school to participate in a fair project in 99% of the cases.
- For participating teachers the school designates a coordinator in 60% of the cases.
- This indicates a felt need as well as a guarantee of success for project development.

Curriculum and project: There is a clear link between the national STEM curriculum and the contents of the fair projects in slightly more than 40% of the cases.
- This shows that either the projects have a broader aim than the curriculum, or that it is difficult to develop sufficiently interesting projects while keeping inside the curriculum boundaries.

Learning from participation: Students learn a lot (94%), they learn to communicate better (89%) and more about the scientific method (90%).
- Also, rewarding students for excellence in STEM (53%) and impacting the way they teach (60%).
- The sensation of getting important personal and professional gains from participating in the fair is important for teachers and students.

Advantages of fairs over classes: Different way of interacting with students (74%) and the students’ motivation (69%).
- Opportunities to engage with the outside world are important (65%).
- These are skills that are not usually associated with regular classroom activities.
Pilot evaluation of Science Fairs in Europe

Analysis and conclusions

Difficulties encountered: Getting students on board is difficult for 58% of the teachers.
• Also finding funding, materials (about 58%).
  ◊ Difficulties in getting students and funding rate equally, but are not in the 80-90% range like other answers in the questionnaire.

Difficulties students encountered: Getting funding, applying the scientific method and the materials for the project all rate similarly at about 55%.
• Supervising students outside the teacher’s area is only difficult for 25%. Filling in the application form for the fair is difficult for 8%.
  ◊ Again, only about 50% of the students or less have some difficulties.

School support: Participation in the fair gets school support in 75% of the cases.
• Support from colleagues, parents and experts come second at about 55% average. Universities rank next at 42%. Least support comes from local authorities, local media or even the national Ministry of Education. The factor is 2-3 times less support.
  ◊ The last items may require more effort from the fair and school management.

Usefulness of the support: Mentors or science experts as well as the school management were considered the most effective, with a big difference (60 and 46%, respectively).
• Colleagues and parents come next but at half the relative importance. The importance of the other sources for support is almost insignificant.
  ◊ The support from the Intel team should probably increase in the future.

Students’ personal traits and success: in the opinion of the accompanying teachers, creativity, communication skills and intelligence, in that order, stand out at 50% or more.
• Perhaps surprisingly, students’ factors like collaboration, scientific literacy and work ethic are considered of less importance in about 25% of the answers.
  ◊ Strikingly, the capacity of leadership got strictly zero responses. It would be interesting to analyse these results in more detail in the future.

Reasons for teachers’ commitment: “My students” predominates (at 94%) and the prestige that comes from the competition (74%).
• Least importance is attributed to the prospect of promotion (29%) followed by the effects of colleagues (43%).
  ◊ These answers may help in designing future announcements and rules for the development of fairs.

Methodology changes: Participation in science fairs results in a 7% increase in the use of inquiry-based teaching with 35% of them using IBSME nowadays.
• However, the data shows that still for 2/3 of the participating teachers the use of IBSME is still an unknown factor in the teaching equation.
  ◊ The science fair initiative has the ambition to help improve school education as regards the necessary transformation and updating of teachers’ methodologies, so that the students’ education is improved in terms of transferable knowledge, skills and competences. One of the key innovating Teaching and Learning methodologies (T&L) is Inquiry-Based Science and Mathematics Education (IBSME), and it is interesting to check the extent to which science fairs contribute towards extending its use.

Teachers’ satisfaction: For 86% of the teachers it is a quite positive experience to supervise students’ projects for the fair competition.
• They would do it again in the future.
  ◊ This is a remarkable result of the whole programme and, in conjunction with students’ opinions, one may conclude that both for teachers and students, participating in the science fairs is an enjoyable and positive educational experience.

Teachers’ further commitment: 26% of the teachers would be interested in becoming a Science Fair Ambassador.
• 32% would have to give it further consideration.
  ◊ Again, this result speaks of a remarkable success of the science fairs among the teachers, who would consider a major involvement in possibly 58% of cases.
OPEN DISCUSSION AND FUTURE WORK
In addition to the results highlighted in the Analysis and Conclusions section, the authors noted a number of issues during the analysis still open to interpretation. Many of these issues open the door to further discussions and could be explored in further studies.

For example, in Table 5 we found that 85% of the students found the Internet / Online support useful for the development of their projects, while only 20% of them had participated in an internship (Figure 13). It is interesting to note the technology peak is present even with science fairs projects. Results from previous studies indicate almost two thirds of finalists pointed out having a mentor as “Important to Very Important” (p.15) to their science fair participation (Rillero et al, 2005). The strong results of today’s student participants use of internet resources may indicate that the ways a mentoring relationship was once understood are being replaced by the large number of online resources, communities and access to less personal expert relationships.

Additionally, in Table 6 we find that Creativity is considered the most essential contribution to the success of a project by the students. It is important to remember these are science students, carrying out research projects for science fairs. Often the stigma attached to science fairs is one of an event attractive to the type of student most often found in the library surrounded by books. In contrast, the student participants suggest that what is really needed are attributes not often considered when thinking about creativity, such as imagination, critical thinking skills and non-traditional approaches to problem solving.

While we have mentioned the increased use of the internet in the implementation of the projects, teachers continue to be the key factor for students’ participation in these fairs. Teachers cannot be replaced by computers and play a critical role in challenging the students and providing them with resources (see Figure 15). On the other hand, parent’s influence appears to be less felt by the students.

Representing the years of teaching experience, Figure 19, illustrates that 40% of current teachers have over 20 years’ in the field, and almost 80% over 10 years. This really indicates new teachers are going to be in need of support in order to get them to join the science fairs with their students.

Figures 29: Impact of participating in the science fairs on both teachers and students (teachers) and 30: Advantages of doing a science fair project over a regular science class (teachers) highlighted two important issues. On one hand, the relatively low responses to “Participating in the science fair promoted scientific inquiry in my school” and “Now, those who participated in the science fair know more about the scientific method” (~60%) compared to the almost 90% to “Now, those who participated in the science fair are better able to apply the scientific method” shows that while a significant impact is perceived in the student’s abilities, it appears to stay at an individual level with limited impact in the school as a whole. This is similar to, on the other hand, the teachers’ impression with “Participating in the science fair has had a big impact on the way I teach” only true for 60% of the respondents compared to “As a teacher, I get to interact with students in a different context” with almost 75% positive respondents. Overall it appears the effects remain at students / teachers participating in the fair and does not get transferred to the school or even the classroom level.

Even more disconcerting is finally the result found in Figure 33, which shows how little involvement appears to come from the local media and authorities (including the Ministries of education).

Overall it appears that while the impact of the fairs is clear for those participating in the fairs, further actions should be made to 1) spread these beneficial effects to the school in general; 2) get the involvement of other parts of the society which are currently unaware or uninterested in the fairs, as they would after all reap the benefits of having more STEM students and more STEM literate citizens as a whole.

# APPENDIX

## SCIENCE FAIRS – TEACHERS’ QUESTIONNAIRE

<table>
<thead>
<tr>
<th>Q</th>
<th>QUESTIONS</th>
<th>ANSWER CATEGORIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>How many times has your school participated in the fair including this year?</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>What is the approximate number of students from your school who competed in the science fair this year?</td>
<td>1 – 4</td>
</tr>
<tr>
<td>3</td>
<td>Is this the first year that you as a teacher participate in your national science fair?</td>
<td>Yes</td>
</tr>
<tr>
<td>4</td>
<td>What subject do you teach primarily?</td>
<td>Science (Physics, Chemistry, Biology)</td>
</tr>
<tr>
<td>5</td>
<td>Have many years have you been teaching?</td>
<td>&lt; 5 years</td>
</tr>
<tr>
<td>6</td>
<td>What is the major focus of the student projects you supervised?</td>
<td>Science (Physics, Chemistry, Biology)</td>
</tr>
<tr>
<td>7</td>
<td>Did students who competed in the science fair participate in an after-school science club / programme / activity?</td>
<td>Yes</td>
</tr>
<tr>
<td>8</td>
<td>Is it compulsory in your school to do a science fair project?</td>
<td>Yes</td>
</tr>
<tr>
<td>9</td>
<td>Is there in your school a person in charge of coordinating the participation in the science fair?</td>
<td>Yes</td>
</tr>
<tr>
<td>Q</td>
<td>QUESTIONS</td>
<td>ANSWER CATEGORIES</td>
</tr>
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<tr>
<td>10</td>
<td>How easy is it to link competing in the national science fair to your national STEM curriculum?</td>
<td>1 – Very difficult 2 3 4 – Very easy There is no national STEM curriculum</td>
</tr>
<tr>
<td>11</td>
<td>To what extent do you agree or disagree with each of the following statements now that you and your students have participated in the science fair?</td>
<td></td>
</tr>
<tr>
<td>11.1</td>
<td>Participating in the science fair encouraged my students to pursue excellence in science, technology, engineering and maths</td>
<td>I fully agree I rather agree I rather disagree I fully disagree Don’t know/Not applicable</td>
</tr>
<tr>
<td>11.2</td>
<td>Participating in the science fair rewarded my students for excellence in science, technology, engineering and maths</td>
<td></td>
</tr>
<tr>
<td>11.4</td>
<td>Participating in the science fair promoted project-based science in my school</td>
<td></td>
</tr>
<tr>
<td>11.5</td>
<td>Participating in the science fair motivated my students to pursue science, technology, engineering and maths careers</td>
<td></td>
</tr>
<tr>
<td>11.6</td>
<td>I as a teacher learnt a lot through participating in the science fair</td>
<td></td>
</tr>
<tr>
<td>11.7</td>
<td>Participating in the science fair has had a big impact on the way I teach</td>
<td></td>
</tr>
<tr>
<td>11.8</td>
<td>My students had fun participating in the science fair</td>
<td></td>
</tr>
<tr>
<td>11.9</td>
<td>My students learnt a lot through participating in the science fair</td>
<td></td>
</tr>
<tr>
<td>11.10</td>
<td>Now, those who participated in the science fair know more about the scientific method</td>
<td></td>
</tr>
<tr>
<td>11.11</td>
<td>Now, those who participated in the science fair are better able to apply the scientific method</td>
<td></td>
</tr>
<tr>
<td>11.12</td>
<td>Now, those who participated in the science fair are better at teamwork</td>
<td></td>
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<tr>
<td>11.13</td>
<td>Now, those who participated in the science fair are better communicators</td>
<td></td>
</tr>
<tr>
<td>11.14</td>
<td>Now, those who participated in the science fair are more excited about science</td>
<td></td>
</tr>
<tr>
<td>11.15</td>
<td>Now, those who participated in the science fair are better able to see how science is relevant to their everyday life</td>
<td></td>
</tr>
<tr>
<td>11.16</td>
<td>Now, those who participated in the science fair are more likely to consider studying a scientific subject</td>
<td></td>
</tr>
</tbody>
</table>
### Q12 In your opinion, what are the advantages of doing a science fair project over regular science classes? [MULTIPLE ANSWERS POSSIBLE]

* Students are more motivated
* Students are the leaders of their learning
* As a teacher, I get to interact with students in a different context
* Students start behaving like actual scientists
* This is a good opportunity to work in an interdisciplinary approach
* This is a good opportunity to engage with the outside world
* This is a good opportunity for collaboration across school years
* Don’t know
* Other, please specify

### Q13 How difficult did you as a teacher find the following activities in particular?

| Q13.1 Getting students on board | 1 - Very difficult | 2 - | 3 - | 4 Very easy | N/A |
| Q13.2 Getting mentors/experts on the topic on board |  |  |  |  |  |
| Q13.3 Getting hold of the materials and equipment needed for the project |  |  |  |  |  |
| Q13.4 Finding funding for the project |  |  |  |  |  |
| Q13.5 Filling in application forms for the competition |  |  |  |  |  |
| Q13.6 Supervising students whose projects were not in my area of expertise |  |  |  |  |  |
| Q13.7 Other, please specify |  |  |  |  |  |

### Q14 And how difficult did your students find the following activities?

| Q14.1 Getting hold of the materials and equipment needed for the project | 1 - Very difficult | 2 - | 3 - | 4 Very easy | N/A |
| Q14.2 Finding funding for the project |  |  |  |  |  |
| Q14.3 Applying the scientific method |  |  |  |  |  |
| Q14.4 Analysing project data (including statistical analysis) |  |  |  |  |  |
| Q14.5 Displaying and communicating their project in a clear and compelling way |  |  |  |  |  |
| Q14.6 Filling in application forms for the competition |  |  |  |  |  |
| Q14.7 Other, please specify |  |  |  |  |  |

### Q15 How much support did you receive from the following people/organisations in particular?

| Q15.1 The senior management of your school | A lot of support | Some support | Not a lot of support | No support at all | Don’t know/Not applicable |
| Q15.2 Your colleagues |  |  |  |  |  |
### Pilot evaluation of Science Fairs in Europe

#### Science fairs – teachers’ questionnaire

<table>
<thead>
<tr>
<th>Q</th>
<th>QUESTIONS</th>
<th>ANSWER CATEGORIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.3</td>
<td>Parents</td>
<td></td>
</tr>
<tr>
<td>15.4</td>
<td>Mentors / Experts</td>
<td></td>
</tr>
<tr>
<td>15.5</td>
<td>Your local authority</td>
<td></td>
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<tr>
<td>15.6</td>
<td>Your local media</td>
<td></td>
</tr>
<tr>
<td>15.7</td>
<td>Local/national science experts</td>
<td></td>
</tr>
<tr>
<td>15.8</td>
<td>Your national Ministry of Education</td>
<td></td>
</tr>
<tr>
<td>15.9</td>
<td>The Intel team</td>
<td></td>
</tr>
<tr>
<td>15.10</td>
<td>Universities / Research institutes / Partnerships</td>
<td></td>
</tr>
</tbody>
</table>

16. Whose support proved most instrumental in your opinion to carry out the projects with your students? [UP TO 3 ANSWERS]

- The senior management of your school
- Your colleagues
- Parents
- Your local authority
- Your local media
- Mentors / science experts
- Your national Ministry of Education
- The Intel team
- Don’t know
- Other, please specify

17. Among the following issues, please select the 3 that are in your opinion most essential to the students’ success with their science fair project? [UP TO 3 ANSWERS]

- Intelligence
- Work ethic
- Critical thinking
- Communication skills
- Scientific literacy
- Curiosity
- Creativity
- Collaboration
- Leadership

18. How important were the following people / factors in your decision to lead students competing in the science fair or made it easier to carry out the projects?

<p>| 18.1 | My school principal | Very important |
| 18.2 | My students | Fairly important |
| 18.3 | My colleagues | Not very important |
| 18.4 | The opportunity to attend our national science fair | Not important at all |
| 18.5 | The opportunity to win prizes / awards | Don’t know / Not applicable |
| 18.6 | The prestige / recognition from competing in the fair | |
| 18.7 | The prospect of promotion | |
| 18.8 | The access to labs from other organizations | |
| 18.9 | Other, please specify | |</p>
<table>
<thead>
<tr>
<th>Q</th>
<th>QUESTIONS</th>
<th>ANSWER CATEGORIES</th>
</tr>
</thead>
</table>
| 19 | Do you feel like supervising students competing in the science fair again - irrespective of whether it’s compulsory at your school or not? | Definitely  
Maybe  
Probably not  
Definitely not  
Don’t know/Not applicable |
| 19A | [IF NO TO Q19] Why not? [MULTIPLE ANSWERS POSSIBLE] | I would like to try out other activities in the future  
It took up too much of my time  
I didn’t enjoy it as much as I thought I would  
I received too little support  
It involved too much paperwork  
Don’t know  
Other, please specify |
| 20 | Did you use inquiry-based teaching in your classes before the first time you participated in the science fairs? | 1- Not at all  
2- Not much  
3- Quite a bit  
4- Always  
x- Don’t know what Inquiry-based teaching is |
| 21 | How much do you use inquiry-based teaching in your classes nowadays? | 1- Not at all  
2- Not much  
3- Quite a bit  
4- Always  
x- Don’t know what Inquiry-based teaching is |
| 22 | Is there anything else you would like to share with us or recommend? | [OPEN-ENDED] |
| 23 | Would you be available for a 15-minute follow-up interview over the phone? | Yes  
No  
Don’t know |
| 24 | Would you be interested in becoming a Science Fair Ambassador in your country? | Yes  
No  
Don’t know |
| 25 | What is the highest degree you hold? | Doctorate  
Master’s degree  
Bachelor’s degree  
School leaving certificate  
Other, please specify |
| 26 | Gender | Male  
Female |
| 27 | Country | List of countries participating in the evaluation. |
APPENDIX

SCIENCE FAIRS
– STUDENTS’ QUESTIONNAIRE
APPENDIX

SCIENCE FAIRS – TEACHERS’ QUESTIONNAIRE

<table>
<thead>
<tr>
<th>Q</th>
<th>QUESTIONS</th>
<th>ANSWER CATEGORIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>How many times have you participated in the fair including this one?</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>More than 3</td>
</tr>
<tr>
<td>2</td>
<td>What is the major focus of your project?</td>
<td>Science</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Technology</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Engineering</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maths</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other, please specify</td>
</tr>
<tr>
<td>3</td>
<td>Did you submit your project as an individual or as a team?</td>
<td>Individual</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Team</td>
</tr>
<tr>
<td>4</td>
<td>How much time did you spend developing the project?</td>
<td>Closed question: 2 - 10 h</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 week</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 month</td>
</tr>
<tr>
<td></td>
<td></td>
<td>several months</td>
</tr>
<tr>
<td>5</td>
<td>Approximately how many hours did you work on the display and presentation part of your project?</td>
<td>1 – 2 hours</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 – 5 hours</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6 – 10 hours</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 week</td>
</tr>
<tr>
<td>6</td>
<td>Did you participate in an after-school science club / programme / activity?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>7</td>
<td>Is it compulsory at your school to do a science fair project?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>8</td>
<td>To what extent do you agree or disagree with each of the following statements?</td>
<td></td>
</tr>
<tr>
<td>8.1</td>
<td>Now, I am more confident at identifying problems</td>
<td>I fully disagree agree</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I disagree</td>
</tr>
<tr>
<td></td>
<td></td>
<td>I agree</td>
</tr>
<tr>
<td>8.2</td>
<td>Now, I am able to communicate better</td>
<td>I fully agree</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Don’t know/Not applicable</td>
</tr>
<tr>
<td>8.3</td>
<td>Now, I am better at team work</td>
<td></td>
</tr>
<tr>
<td>8.4</td>
<td>Now, I am better at finding solutions or coming up with new ideas</td>
<td></td>
</tr>
</tbody>
</table>
### Q 8.5 I had fun competing in the science fair
### Answer Categories
- *You have a project of your own
- *You are the one in charge
- *You feel like a real scientist working on a real project
- *You get the chance to show your work to the outside world
- *Mistakes are allowed
- *You get to work with teachers from various subjects
- *No marks are involved
- *You get to work with people from out of school e.g. experts, students, etc.
- *You are part of a mixed group of students from various classes and levels
- *None of these
- *Don’t know

### Q 8.6 I learnt a lot through competing in the science fair

### Q 8.7 Now, I know more about the scientific method

### Q 8.8 Now, I am more excited about science

### Q 8.9 Now, I can see better how science is relevant to my everyday life

### Q 8.10 Now, I am more likely to consider studying a scientific subject

### Q 8.11 Now, I am more attracted to the prospect of a scientific career

### Q 9 In your opinion, what are the advantages of doing a science fair project? [MULTIPLE ANSWERS POSSIBLE]

- *You have a project of your own
- *You are the one in charge
- *You feel like a real scientist working on a real project
- *You get the chance to show your work to the outside world
- *Mistakes are allowed
- *You get to work with teachers from various subjects
- *No marks are involved
- *You get to work with people from out of school e.g. experts, students, etc.
- *You are part of a mixed group of students from various classes and levels
- *None of these
- *Don’t know

### Q 10 How difficult did you find the following activities in particular?

#### 10.1 Coming up with a topic

#### 10.2 Getting hold of the materials and equipment needed for the project

#### 10.3 Finding funding for the project

#### 10.4 Formulating your project hypothesis

#### 10.5 Testing your project hypothesis

#### 10.6 Analysing project data (including statistical analysis)

#### 10.7 Drawing conclusions from project data

#### 10.8 Displaying and communicating your project in a clear and compelling way

#### 11 How useful were the following sources of knowledge and experience in providing support with your science project?

#### 11.1 Teacher(s)

<table>
<thead>
<tr>
<th>Q</th>
<th>QUESTIONS</th>
<th>ANSWER CATEGORIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.5</td>
<td>I had fun competing in the science fair</td>
<td>*You have a project of your own</td>
</tr>
<tr>
<td>8.6</td>
<td>I learnt a lot through competing in the science fair</td>
<td>*You are the one in charge</td>
</tr>
<tr>
<td>8.7</td>
<td>Now, I know more about the scientific method</td>
<td>*You feel like a real scientist working on a real project</td>
</tr>
<tr>
<td>8.8</td>
<td>Now, I am more excited about science</td>
<td>*You get the chance to show your work to the outside world</td>
</tr>
<tr>
<td>8.9</td>
<td>Now, I can see better how science is relevant to my everyday life</td>
<td>*Mistakes are allowed</td>
</tr>
<tr>
<td>8.10</td>
<td>Now, I am more likely to consider studying a scientific subject</td>
<td>*You get to work with teachers from various subjects</td>
</tr>
<tr>
<td>8.11</td>
<td>Now, I am more attracted to the prospect of a scientific career</td>
<td>*No marks are involved</td>
</tr>
<tr>
<td>9</td>
<td>In your opinion, what are the advantages of doing a science fair project? [MULTIPLE ANSWERS POSSIBLE]</td>
<td>*You are part of a mixed group of students from various classes and levels</td>
</tr>
<tr>
<td>10</td>
<td>How difficult did you find the following activities in particular?</td>
<td>*None of these</td>
</tr>
<tr>
<td>10.1</td>
<td>Coming up with a topic</td>
<td>*Don’t know</td>
</tr>
<tr>
<td>10.2</td>
<td>Getting hold of the materials and equipment needed for the project</td>
<td>1 - Very difficult</td>
</tr>
<tr>
<td>10.3</td>
<td>Finding funding for the project</td>
<td>2</td>
</tr>
<tr>
<td>10.4</td>
<td>Formulating your project hypothesis</td>
<td>3</td>
</tr>
<tr>
<td>10.5</td>
<td>Testing your project hypothesis</td>
<td>4 - Very easy</td>
</tr>
<tr>
<td>10.6</td>
<td>Analysing project data (including statistical analysis)</td>
<td></td>
</tr>
<tr>
<td>10.7</td>
<td>Drawing conclusions from project data</td>
<td></td>
</tr>
<tr>
<td>10.8</td>
<td>Displaying and communicating your project in a clear and compelling way</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>How useful were the following sources of knowledge and experience in providing support with your science project?</td>
<td>1 - Not useful at all</td>
</tr>
<tr>
<td>11.1</td>
<td>Teacher(s)</td>
<td>2 - Not very useful</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 - Fairly useful</td>
</tr>
</tbody>
</table>
### Q11.2 Mentor / Expert in the field

#### Answer Categories

- 4 - Very useful
- Don’t know/Not applicable

<table>
<thead>
<tr>
<th>Q11A</th>
<th>If you had a mentor or an expert in the field to support you, what was her/his profession and how did you meet/find her/him?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open-Ended</td>
<td></td>
</tr>
</tbody>
</table>

### Q12 Did you participate in an internship related to your project?

- Yes
- No

### Q13 Among the following items, please select the 3 that are in your opinion most essential to the success of a science fair project? [UP TO 3 ANSWERS]

- Intelligence
- Work ethic
- Critical thinking
- Communication skills
- Scientific literacy
- Curiosity
- Creativity
- Collaboration
- Leadership

### Q14 How important were the following people/factors in your decision to compete in the science fair?

#### Q14.1 My teacher(s)

1 - Not important at all
2 - Not very important
3 - Fairly important
4 - Very important

#### Q14.2 My parents

#### Q14.3 The opportunity to attend our national science fair

#### Q14.4 The opportunity to win prizes / awards

#### Q14.5 The prestige / recognition from competing in the fair

#### Q14.6 My friends were competing in the science fair too

#### Q14.7 The opportunity to do a real science project like a real researcher

#### Q14.8 The opportunity to do something science-related that’s different from what we do at school

#### Q14.9 The personal attention I received from my mentor / teacher

#### Q14.10 The opportunity to improve my application to university

- 1 - Not important at all
- 2 - Not very important
- 3 - Fairly important
- 4 - Very important
- Don’t know/Not applicable
### Pilot evaluation of Science Fairs in Europe

**Science fairs – students’ questionnaire**

<table>
<thead>
<tr>
<th>Q</th>
<th>QUESTIONS</th>
<th>ANSWER CATEGORIES</th>
</tr>
</thead>
</table>
| 15 | How useful were the following sources of knowledge and experience in providing support with your science project? | 1 Definitely not  
2 Probably not  
3 Maybe  
4 Definitely  
Don’t know/Not applicable |
| 15A | [IF NO TO Q15] Why not? [MULTIPLE ANSWERS POSSIBLE] | ✪ I would like to try out other activities in the future  
▪ It took up too much of my free time  
▪ I didn’t have so much fun  
▪ I got discouraged because most of my experiments failed  
▪ Most of my friends are not interested in joining  
▪ Other, please specify |
| 15B | [IF YES TO Q15] Would you recommend competing in the fair to a friend? | 1 Definitely not  
2 Probably not  
3 Maybe  
4 Definitely  
Don’t know/Not applicable |
| 16 | Is there anything else you would like to share with us or recommend? | [OPEN-ENDED] |
| 17 | Would you be available for a 15-minute follow-up interview? | Yes  
No  
Don’t know/Not applicable |
| 18 | Age | <10, 10, 11, 12, 13  
14, 15, 16, 17, 18  
19, 20, 21, >21 |
| 19 | Gender | Male  
Female |
| 20 | Country | List of countries participating in the evaluation project |