Abstract. Three years ago the Science Fair “Hands-on Science” was established with focus on upper basic and high school levels. In April 2013 the third edition of the hands-on science network science fair was organized, in Viana do Castelo, Portugal. For the first time, the science fair was organized within a school, with the participation of students as the staff. The fair took also place in a different city, smaller and with a lesser number of schools in the region. In this communication we intend to show the evolution experienced in organizing this event over the last three years. Replies to questionnaires prepared for both students and teachers allowed us to assess our initiative and draw conclusion that will be presented herein. We will review how the work was carried out in different schools. We show how to organize a large scale science fair within a school environment and suggest methods to include these activities in a school daily context.

Keywords. Hands-on, science fairs, school organization

1. Introduction

The main role of the schools is training young peoples to become active individuals within societies. This requires a teaching approach based on varied and diverse strategies in order to enable the acquisition of the required knowledge and the development of skills at the procedural, conceptual and attitudinal level [1].

Despite the curriculum orientations, the lack of time, resources, or even experience from teachers and students leave the teachers that are usually responsible of regulating the strategies they should use at the classroom give all the subjects, goals, methods and approaches to data collection given little or no space to students’ effective intervention. Some authors state that this fact could be responsible by given students a wrong idea about science [2]. If students didn’t learn about science and how to do science, the real comprehension about the scientific and technological literacy is being compromised [3].

Here arises the great advantage of science fair projects, because students are encouraged to pursue their own goals and ideas [3]. Therefore, they have the opportunity to explore and solve problems related with their personal interest and also subjects about the world that surround them. Usually this allows a relation between science and different school subjects or with everyday life phenomena [4]. Therefore, students' participation is useful to science classes since they gain the habit of registering data and taking notes, as well as patience and resilience on the pursuit of their objectives [5]. They learn and statistical data and others forms or organize information, such as the use of graphs and tables to present their results, use adequate and varied literature to help their argumentation, and learn the practices of research in science, and a widened scientific vocabulary [3].

2. The 3rd Science Fair organization

During the school year of 2010-2011 the first edition of the science fair was organized [6]. The second edition was in May of 2011-2012 [7]. Taking into account the wide acceptance by teachers, participating students, and visitors, it was decided to continue with the initiative and organize the 3rd edition, in April of the current year.
The organization of the fair was made in the same way, with two differences: it was organized in a different city and the organization was in charge of a school, the Colégio do Minho, in Viana do Castelo. However, the fair was still aimed to students from the 5th to 12th grade (aged 10 to 18 years) from regular or professional education and was divided into 3 age categories; 5th and 6th grades, 7th to 9th grades and from 10th to 12th grades.

The main goal was for students to develop a scientific project in any field. Several factors were evaluated, such as scientific rigor, quality of presentation, originality, and interdisciplinarity.

The science fair announcement continues to be made at the beginning of the school year by e-mail to schools and teachers and publicized at the science fair website. The news was publishing in journals and the school that organized also publicized along the city’s schools. After all the schools proceed to their registration, we plan the space for the exposition and lunch to all the teams. And at the Science Fair day, the older students from Colégio do Minho, were the staff. They were responsible for distributing the tables according to the plan prepared in advance based on the needs of each group. They guide the groups to their places, distributed the kit of participation and were always there to help with any need.

3. The evolution of the fair participation

The science fair has evolved positively, on the number of participants, visitors and in the quality and diversity of the projects presented.

On Table 1 it is possible to see how the number of responsible teachers from projects, the number of projects and the number of participants evolved.

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<tr>
<td>Nº of schools</td>
<td>8</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>Nº responsible teachers</td>
<td>9</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>Nº of projects</td>
<td>38</td>
<td>58</td>
<td>42</td>
</tr>
<tr>
<td>Nº of participants</td>
<td>131</td>
<td>178</td>
<td>114</td>
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The first fact here pointed is that, despite the science fair be divided into three categories, only the 1st edition had related projects in the category of the youngest.

In addition, when we look to Table 1, despite the number of schools participation and teachers remains the same, is possible to verify the decrease of projects. This fact was essentially explain by the fact of the fair happens one month earlier when we compare with the two previous editions. Students haven’t enough time to finish their projects. Two schools didn’t bring any projects because of this fact and others bring only some of the projects because students weren’t capable of finishing them on time. Another factor pointed out by teachers is the lack of resources and facilities available in schools due to the new measures implemented in Portuguese schools.

On the other side, is important to refer that all the schools participants and teachers involved are practically the same from previous editions or teachers that knew other teachers that already participated or visited previous editions and publicized this event. Actually, we have not much success on bringing new schools from Viana do Castelo to participate. In reality only one school that had never participated or visited the previous editions accepted the challenge.

But we accomplished one thing: others schools visited the fair and with that and all the publicity that was made on newspapers and even on television had a great feedback. And we expect that next year more schools from this city accept the challenge of participate.

4. Teacher’s opinion

The analysis of the questionnaires over the three years allows us to verify that teachers have been providing more time to work with students, as you can see in figure 1.
Figure 1 - Time available from teachers to help students on the three editions of the science fair.

On Erro! A origem da referência não foi encontrada., we can see how teachers managed their time to help students. In a general way, teachers involved their subjects on the development of the projects. Most interesting was the fact that on the first two editions teachers of physics and chemistry were the most active, followed by biology, but in less number. On this edition, have a stronger presence, either in the number of teachers who guided the project, and either in the number of projects themselves. Another pleasant surprise was the participation of teachers with students of vocational education, which until now has been virtually nonexistent.

Contrary to what has happened in previous years, despite the teachers are involved more hours on the development of the projects with their students, their implementation in the classroom seems to be decreasing. They seems to canalized their projects more to science clubs, leisure time or other situations like the named study rooms.

This also leads to the explanation of the fact that the decrease of projects by teacher, because, being developed outside of the classroom, there is no requirement to involve all students in this activity, but only those who really want to participate.

For the work done by the students, in general, in the three editions, teachers believed that the students worked with a lot of enthusiasm, commitment, imagination, rigor and autonomy and recognized that the students' participation in this project has brought some benefits to their subjects but that the participation in these science fairs, allowed the students developing skills beyond those that would be necessary only for their subject.

Thus, this is a type of activity that all teachers say they will continue to work. The majority seems to be convicted that is possible to implement science fair projects in classes, but they pointed the lack of time as a possible problem and the need of coordination with teachers from other fields and the school community in general can also be hard to do.

5. Student’s opinion

When questioned about the reasons that led them to participate in this activity, the students, in the three editions, gave us several answers, being the most predominant, the fact that they like science, as it is possible to see on Figure 2.

The fact of students participate at the science fair because it counts to their evaluation has always been point out, despite very few students pointed this reason as the only reason to participate. However, this year there is a reduction in this answer, which is directly linked to the fact that more projects are being developed outside the context of the classroom.

On the other hand, the fact that the students visit other science fairs, including previous editions of this or had participated previously, are two factors that led them to want to participate in this 3rd edition.

The fact that students and teachers are more familiar with what is expected from projects for a science fair, has led to an increase in the time available for their development, as is possible to see on Figure 3. Their greater dedication of time has led to projects of greater originality and quality. Many of the students are no longer looking for experiences to reproduce. They look
for innovation and lead a serious investigation including different tests of different hypothesis, and statistical studies of their work throughout the year.

Figure 3 - Time schedule for student’s to develop their projects, during the three editions (1st edition - left bar; 2nd edition – middle bar; 3rd edition – right bar).

When questioned about where students worked on the projects, we find something interesting and that apparently seems to contradict what the teachers said earlier about the time available in subjects for the development of projects, as is possible to see in Figure 4. For teachers, this trend seemed to be declining while the responses of students remain approximately equal over the three editions. However, this is easily explained. Teachers who answer to this inquiry are those who accompanied the students to the fair. But according to several students, there is a wide interdisciplinarity between teachers who assisted in the development of projects. It is found mainly among teachers of physics and chemistry and math, or between physics and chemistry and biology (in Portugal, Physics and Chemistry is only one subject and the teacher is only the same).

In addition, these students continue to show their interest in science by the time they seem to devote to these projects, both at home and at school, in their spare time.

Figure 4 - Places were students work to their project, in percentage (1st edition - left bar; 2nd edition – middle bar; 3rd edition – right bar).

Figure 5 reveals one more time what was said previously. Teachers of physics and chemistry seemed to be more involved, and their involvement increased significantly, followed by biology teachers. The great news come from math, that appears as a fundamental peace for some of the projects. And this came associated to the fact of students became more concerned with the statistical treatment of their work or prove through calculations some aspects of their works.

Figure 5 - Aid provided to students throughout the three editions, in percentage (left bar – 1st edition; middle bar – 2nd edition; right bar – 3rd edition).

Behind that, family and friends continue to seem a constant help on the development of their projects. And this aspect is very important because it means that not only the mentors of the project learn something new, but they are also capable of involve others on this journey.
Figure 6 allows us continue the analysis about the advantages for students to participate on science fairs. And in all of the editions the answers were similar. The most mentioned by students is that it helped them to understand some new concepts.

The capability of develop, with success, the team work is also an important aspects for their future, as well as the fact they developed laboratory skills that help them in classes as physics and chemistry (whose curriculum has a large laboratory component) and the organization of information that can be useful not only at school but also on their daily life because they gained method to organize their ideas.

6. The 4th Science Fair Hands-on Science

Our research work on Science Fairs will be further continued. 4th edition will follow the same characteristics

We intend to see if there will be a greater compliance by schools of Viana do Castelo, who’s now visited the fair and already understand our objective.

We will follow with this study and try to observe the evolution of the fair and the opinion of teachers and students and to verify if trends herein reported remains.

7. Conclusions

These three years of science fairs clearly enabled us to conclude that this is an activity welcomed by teachers and students. The proofs are the fact that some of them participate more than once at our science fair or the fact of all students and teachers said that would like to repeat the experience.

We can also conclude that this familiarity by the real mean of science fair projects allow the effective development of various valuable skills, competencies and knowledge, at a procedural conceptual and attitudinal level. That means that it is really possible to use this kind of projects to teach concepts or to help students to understand them. The major problem is for that happens with success is necessary time and habit, both by teachers and students, in order to be possible to develop these projects in the classroom for the entire class and not only some of the students. But that we only are capable of combat with time and divulgence of these events.

Other important fact on the quality of the projects is the time available for their development but also the promotion of interdisciplinarity. Equal important is the social, familiar and scientific relationship that is possible to establish when family and friends are involved in science fair projects.

Finally, we are capable to prove that is interlay possible to a school organize a national event like this science fair. And the involvement of the oldest students as part of staff was a very interest and motivating idea. They gain a big sense of responsibility and all of them would like to repeat the experience.

8. Acknowledgements

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9. References


