

2nd Portuguese Science Fair “Hands-on Science”

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Abstract. *Sciences fairs are activities with great pedagogical potential, in particular when in some way connect to the school in-classroom teaching/learning activities. Two year ago the Science Fair “Hands-on Science” was established focus on upper basic and secondary school levels. In May 2011 the second edition of the hands-on science network science fair was organized, in Braga, Portugal.*

In this communication we intend to show the evolution experienced in organizing this event over the last two years, school’ teachers’ and students’ response and the impact it had. We will discuss the goals and the strategies employed, the challenges faced and the solution found. The replies to questionnaires prepared for both students and teachers allowed us to assess our initiative and draw conclusion that will be presented herein. An increase on students and teachers satisfaction was observed and we were able to study the influence of recent curricular changes on the development of the science projects.

We will review how the work was carried out in different schools and suggest methods to include these activities in a school daily context.

Keywords. Hands-on, science fairs.

1. Introduction

It is common for students to feel that the content they learn in school has no application in real life making the development of science classes often rather complicate for the teacher and student [1,2]. Students should feel motivate to learn and to achieve their objectives [1]. It is the teacher’s role to find the better way to engage students. The most important isn’t what to teach, but how to teach and what kind of activities to select for helping students [2].

Current studies reveals that the learning process should not only focus on classroom activities [3]. Therefore we want to explore an

activity that could help students and teachers to achieve a larger success in the learning of sciences: Science Fairs.

Science fairs are cultural and pedagogical activities, based on hands-on activities. Students have the opportunity to research and develop science project that thereafter will be displayed and discussed with peers and visitors and that are normally evaluated by adult judges [4]. It requires and effectively involves the students actively on their learning process, and, when on developing their scientific projects they learn science and learn how to make science. This scientific productions also can be expose to other people to see and learn with it [5]. Students develop skills that can be useful for their life as students and future careers related with science [3].

2. The 2nd Science Fair organization

During the school year of 2010-2011, the first edition of the science fair was organized [6]. Taking into account the wide acceptance by teachers, participating students, and visitors, it was decided to continue with the initiative.

As for the first edition the science fair announcement was made at the beginning of the school year by e-mail to schools and teachers publicized at the science fair website and also on the website of the University of Minho.

The registration was to be done in two phases: the first when students manifested their willingness to participate giving an idea on the number of participants and a general indication about the project that each group was planning to develop; and a second phase, closer to the date of the science fair, where students gave to the Science Fair organizers the final information about their work and their presentation needs such as workspace, electricity, water supply,...

The fair was aimed at 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.

On the day of the fair, all participants received a certificate and a t-shirt. It was also assigned a 1st, 2nd, and 3rd prizes along with honorable mentions. It is important to stress that these awards and honorable mentions were only symbolic since the goal is to challenge students to learn as much as possible, while having fun, and not to compete for major prizes.

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 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.

Table 1 - Resume from participation on the two editions of the fair.

	1 st edition	2 nd edition
Nº of schools	8	9
Nº responsible teachers	9	14
Nº of projects	38	58
Nº of participants	131	178

Despite the number of schools remained approximately equal, the number of teachers responsible for the projects increased. That means that some of the colleagues that already participated on the first edition urged other teachers from their school to also participate. This means that a wider spread of this event will quickly translate into greater acceptance and participation.

During the year, 5 teachers in charge of 4 different schools chose not to participate. One didn't present a plausible argument, two failing to finish the project and the remaining 2 teachers who had already participated in the previous year, just did not to participate for economic reasons, since participation involved the payment of the travel expenses in one of the cases. Similar problems occurred in the 1st edition of this event.

4. Teacher's opinion

To better understand the evolution of this event, at the end of each edition the same questionnaire was distributed to the responsible teachers.

One of the facts to be aware was how much time was available to help students and in what circumstances it was done.

Observing the Figure 1 it is possible to see that, in second edition, teachers had more available time than in the first edition.

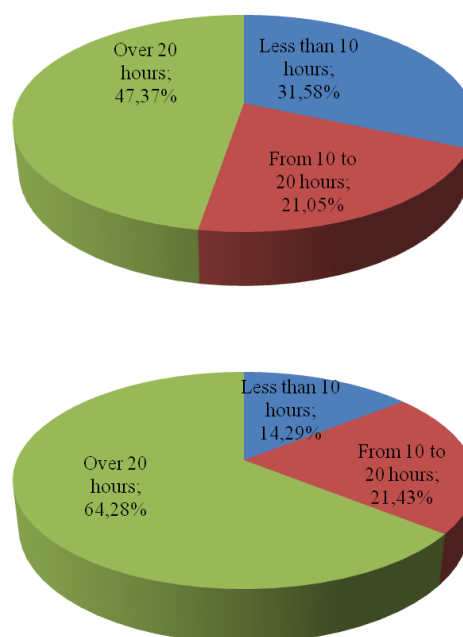


Figure 1 - Time available from teachers to help students on 1st (top plot) and 2nd (bottom plot) edition of the science fair.

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 their projects. Most interesting was the fact that teachers of physics and chemistry were the most active, followed by biology, but in less number. The appearance of other subjects beyond these seemed to be only occasional. Therefore, now it is necessary to wait for the 3rd edition to see if this trend continuous or if teachers from others subjects started to participated, even if in collaboration with other fields.

During the first edition, a subject called project area, was inserted into the Portuguese curriculum. This "subject" without a mandatory

curriculum aimed to teach students to develop projects, and as you can see, several teachers (16%) chose to develop science fair projects to this science fair. With the extinction of this “subject”, teachers seemed to start focusing more on science clubs or other projects (others) developed by schools that allowed the inclusion of participation in the science fair. However, this work done by teachers and students is still fairly supported by other teachers, students and members of the school board.

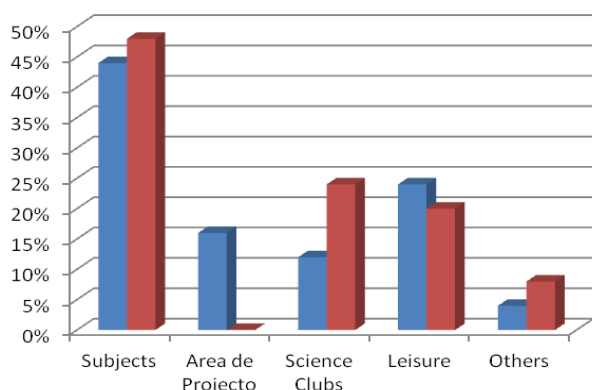


Figure 2 - Places where teachers helped their students (left bar – 1st edition; right bar – 2nd edition).

The fact that these projects are being developed in classes, has led to an increase in the number of teachers who have this work as an evaluation in their subject.

It is important to note that this seems to happen more often with 12th grade students (last year before university) in the subjects of physics, chemistry and biology. However, these subjects are optional, chosen by students and their main objective is to stimulate students to careers that involved them and prepare them for college education in the field. In addition, the themes of these students were quite diverse, not appearing to have been the imposition of themes. In other words, these students had the freedom of choice, which is important for their motivation.

A case to refer was of a school with students from the 7th grade (first year of physics and chemistry on their curriculum), where all their projects were based on a theme related with the physics and chemistry curriculum. But even there students participated and seemed motivated. However, the similarity between the projects did not allowed any of them to stand out. The same fact happens on the 1st edition with some groups from 10th grades, where all the

groups developed projects related with renewable energies.

For the work done by the students, in general, in the two editions, teachers believed that the students worked with a lot of enthusiasm, commitment, imagination, rigor and autonomy. However, the imagination, rigor and autonomy are aspects that can still be improved.

Teachers say that the students' participation in this project has brought some benefits to the discipline which focused on his work, but that the benefits were even more general. Participation in these science fairs, allowed 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. And insert the development of scientific projects in the classroom is a possibility for 75.76% of the teachers surveyed. The other teachers, despite recognizing the benefits of the activity, say it is not possible to include these projects in the classroom due to the large extension of the curriculum. It should be noted that even for teachers that consider feasible the inclusion of science fair projects in the classroom, consider the curriculum too extensive, and need the coordination with teachers from other fields and the school community in general.

5. Student's opinion

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

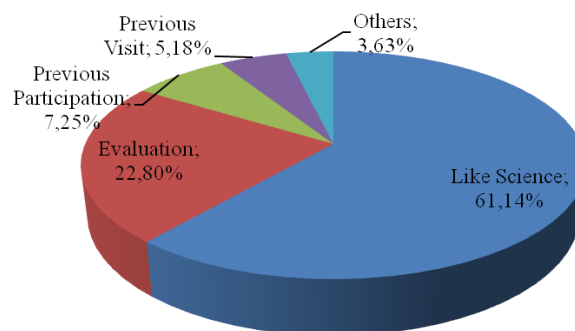


Figure 2 - Reasons for student's participation.

22,80% of the students presented as a motive the fact that their participation counts to their evaluation. However, from these students only 13,47% gave it as the only reason. The others

factors were the previous participation or visit to others fairs, including the first edition of this science fair. The other answers were essentially related with the fact that students felt a curiosity and wanted to experiment.

Despite the reasons for students participation, at the end of the fair, 96,4% of them left with the desire to repeat the experience. This means that from a universe of 309 students only 7 said that they didn't want to repeat and 4 didn't answered. To know under what conditions the students worked, we questioned about the duration of project development, as seen in Figure 3.

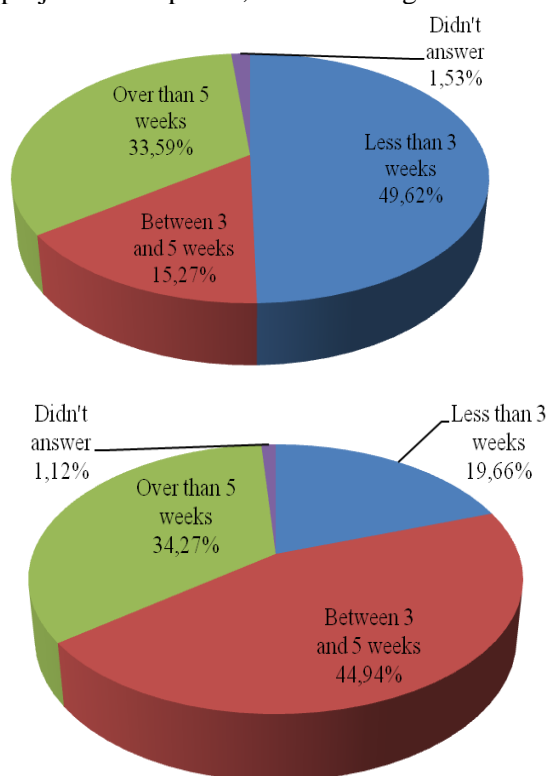


Figure 3 - Time schedule for student's to develop their projects, during the 1st (top plot) and the 2nd edition (bottom plot).

With this information it is possible to see a significant increase on the time spent by students, and these projects are being done throughout the school year.

In Figure 4 we can see the places where students worked more for science fair projects. A large percentage of students worked at school, during class, in both editions, in agreement with the answer given by the teachers. The same way we can see that there are no major changes regarding the number of students who worked at home or in their free time at school. However, it is interesting to see that the number of students that decided to spend their spare time working is quite high.

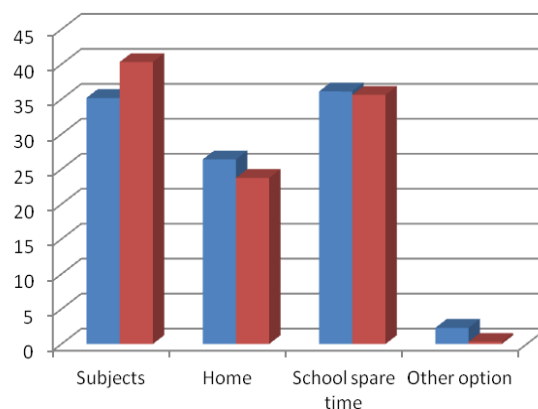


Figure 4 - Places were students work to their project, in percentage (left bar - 1st edition; right bar - 2nd edition).

Finally, it was decided to figure out who these young scientists relied for help in developing the project. The Figure 5 proved what was said previously. Teachers of physics and chemistry seemed to be more involved, and their involvement increased significantly. Then comes biology teachers, geology, and the remaining subjects appeared punctually.

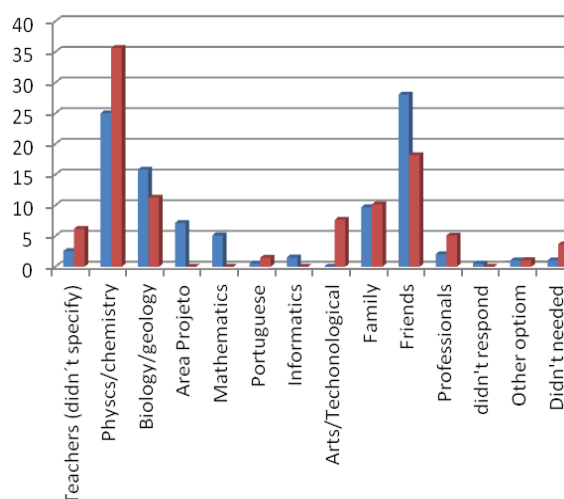


Figure 5 - Aid provided to students throughout the two editions, in percentage ((left bar - 1st edition; right bar - 2nd edition).

After the help of teachers from various subjects, friends seem to be the most requested help. However, still sees a demand of family members for help in developing the project, as well as the demand for specialists in the field of work.

The last question was to understand what students thought about the development of science projects, as it is possible to see in Figure 6. The answers on the two editions were very similar. The most mentioned by students is that it helped them to understand some new concepts. That means that it is really possible to use this kind of projects to teach concepts or to help students to understand them.

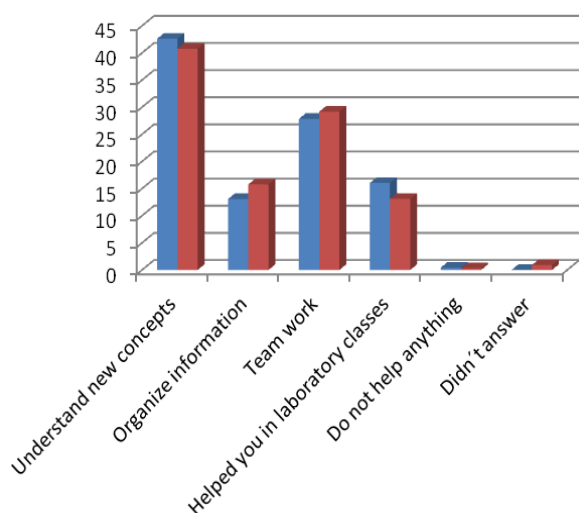


Figure 6 - Benefits for participating in the science fair, in percentage (left bar – 1st edition; right bar – 2nd edition).

One important aspect of this activity was to help them to work in team. This can be proven, given the previous answers that reveal that, apart from working in the context of the classroom, these students have provided much free time at home and at school.

Finally, some of the students referred that these activities also helped them to learn to select and organize information and to handle lab materials, skills that can be useful in classes, especially in laboratory.

6. The 3rd Science Fair Hands-on Science

Our research work on Science Fairs will be further continued. 3rd edition will follow the same characteristics of the previous ones with a change on the location. This time, it will be organized in a school at the coastal town of Viana do Castelo. The Fair will be organized with the help of the school community, including older students. The students that will not want to present a project will be co-responsible for the science fair organization.

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 two years of science fairs clearly enabled us to conclude that this is an activity welcomed by teachers and students allowing the effective development of various valuable skills competencies and knowledge, at a procedural conceptual and attitudinal level.

Despite the extension of programs leading to a lack of time for the development of a scientific project, teachers and students seem to be able to find a way to successfully incorporate it in the context of the classroom. There is a greater involvement of both, students and teacher, in trying to make the learning/teaching experience successful, even if it means working extra during leisure time both at school and at home...

8. Acknowledgements

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9. References

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