

Science Fairs as Learning Tool for Teaching Excellence

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Abstract

Science fairs are usually considered to be a pedagogical and cultural activity that involves the students actively. Gifted students need challenges to further develop their skills while maintaining the motivation level. Science fairs may provide the informal environment that will request and allow these students of excellence to challenge themselves by developing a scientific research project. Despite being well known in different countries, in Portugal first steps are being made on the use and implementation of science fairs as effective pedagogical tool.

In this work, we will present a 4 years study that was developed on a Portuguese school with the main goal of evaluating the advantages of this informal way of teaching. The study includes an analysis of the evolution of the students' knowledge that have participated, or visited, the different science fairs. Some advices for the implementation of these projects will be given. The motivation of the students was monitored as well as the knowledge and skills effectively improved by this activity.

1. Introduction

Teaching quality is not synonymous of an equal strategy for all [1], and some times we have the necessity to adapt strategies according to the social and economic environment and also to the culture and knowledge background of our students. One strategy that we can use is to promote curriculum changes that meet the needs of particular students [1].

The effort is done searching strategies that encourage students to learn aiming mostly the combat of school failure and dropout. It is necessary however not to forget to look for strategies to involve all the students including excellent or gifted students that have and poses particular problems.

Partly due to this fact the Portuguese Minister of Education created the so called development plans. These plans were created to stimulate the students that have learning above average skills. These plans are a set of activities that can be developed on curricular area, at school or under the guidance. One of the options to use with these gifted students during their “development plan” are activities of enrichment, like problem solving [2].

Therefore, the development of scientific projects meets the requirements for the established objectives.

Hands-on activities, where the active commitment of the students is fundamental, require all the students to participate. Science fairs are cultural and pedagogical activities, based on hands-on, where students work on view of the opportunity to display and discuss scientific projects they own developed actively, and that are normally evaluated by an adult judge [3, 4].

To participate at a fair, students have first to overcome different phases: subject search, project development, experiment and problem solving, preparation of the presentation, and the final science fair presentation [4,5,6].

This activity has the advantage of promoting students enthusiasm toward science, and, in each phase, to develop important skills, like research capability, decision making, but also communication skills. This gives also the opportunity to interact with other students interested in science [3-8] and could be an activity that promotes the development and motivation of gifted students.

2. Science Fairs – A case study

A study about the importance of science fairs on students learning is being developed at a school, in the city of Viana do Castelo, Portugal, during the last four years and is has been partially reported elsewhere [5,7,8]. This school, Externato Maria Auxiliadora, is a private catholic school with 135 students from the 5th to the 9th grades (ages between 10 to 15 years old).

We organized the science fair this year for the 4th consecutive year. Students, with the support of the school and teachers developed, in a voluntary basis, scientific projects extra classroom and presented them at the end of the year to all school community and abroad.

On the first edition 42,9% of school' students have participated but only from 7th to 9th grades; on the second edition 65,6% of the students participated and on the third edition 77,9%. This year on the fourth edition we reached the 82,6% mark.

With the main objective of knowing students’ opinion about science fairs, and the impact it might had on their education, a questionnaire was distributed to 121 students at the beginning of the year of this 4th science fair.

To evaluate student’s knowledge, a theoretical inquest was made at the beginning of the school year and at the end, after the science fair. The question presented was a very simple and specific one: why a boat of 45 ton is capable to float? This question was based on a project developed by 2 girls from the 5th grade (10 years old) on last edition of the science fair.

Figure 1 demonstrates the evolution of the students answers. It is possible to see that the number of students that did not answered decreased from 40,5% to 19,1%. On what concerns the number of incorrect replies most students did not know why this fact happens and say that it might be because of the characteristics of the materials boats are made of, or else give illogical answers. Although not very high it was possible to notice that the misconception decreased from 42,1% to 34,7% after the science fair process (yet with projects not directly related to the subject it self).

On the other side the number of answers partially correct increased from 8,3% to 23,1%. Here, students refer essentially the fact that a large part of the boat is hollow allowing the fluctuation. Finally the number of correct answers increased from 9,1% to 23,1%.

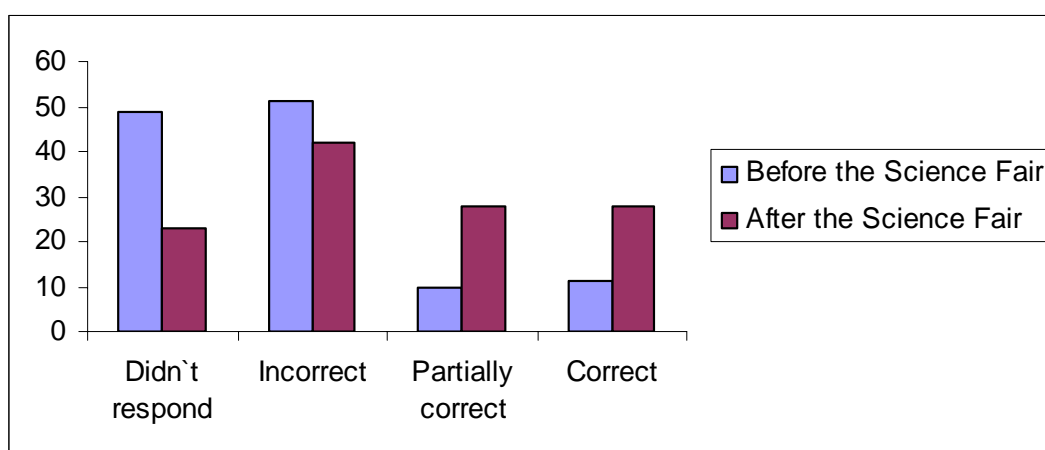


Figure 1 - Answers from students to the theoretical question

3. Science Fair organization: initial considerations

To know how, when and with whom to organize a science fair it is necessary to take into account some considerations:

Where can science projects be developed?

If teachers want to implement science projects, the first thing they have to do is thinking where and with whom they will be working. On Figure 2 we demonstrate some of the most usual applications of the science projects.

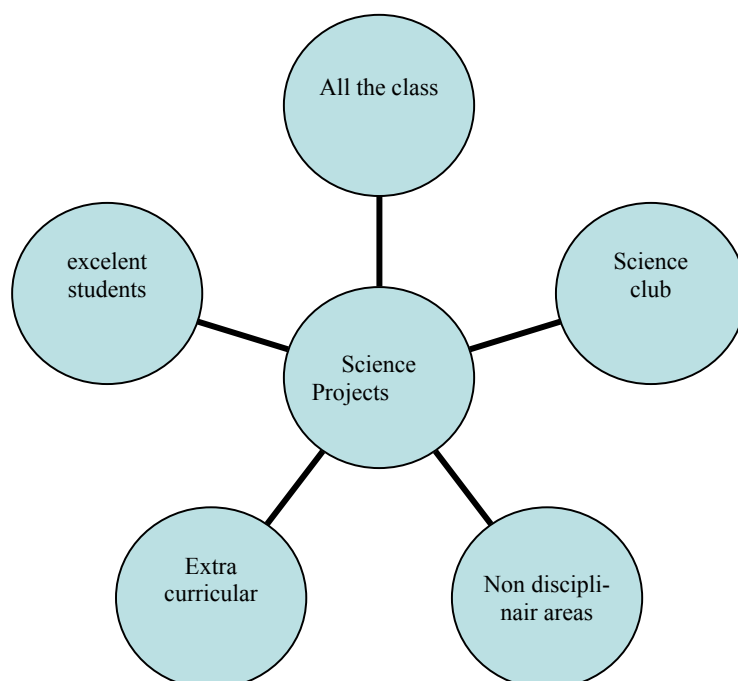


Figure 2 - where science projects can be developed.

When this activity is applied to a subject, usually it is mandatory for all the classroom. However, this is not a problem since students want to do different things at school and this project development stimulates their curiosity and their willingness to learn despite the extra work. In the other hand, we can apply only to excellent students that have the “development plans”. On this case, students that usually conclude their work before the

others can work on their “free time” instead of waiting for others or continue to repeat exercises that do not stimulate them.

It is possible to make this activity optional and to students that belong to a science club or also as an extracurricular activity.

Whatever the case, the first thing that teachers had to do is to think in all the details, in order to manage all without too much work and without any problem.

What kind of projects should be developed?

The ideal theme choice is when students have total liberty on their choice, based in something that they had curiosity, which is more stimulating... even better if the science project are interdisciplinary. However, despite all the advantages for students and teachers, that can divide the work, this implicates an involvement of some teachers that is not always possible. Therefore, if that could not happen, the ideal is to students to have some hypotheses of themes and then select what raises more interest.

Calendar of the projects:

When the teacher talks with the students about the development of these projects they have to establish a calendar where students know the different phases that they had to accomplish. On this calendar some dates should be schedule to discuss the project and make the point of situation.

Normally it is better if students develop only one project during all the year to be possible to conduct a real investigation and made one good project instead of many small ones.

Where the projects can be presented?

On all the situations (except if is an extracurricular project) one possibility is to present these projects in the classroom or at the science club. However, other activities could be made, like showing the projects during the science week, at a science fair organized by the school, or by others national and international institutions.

It is a benefit for students and visitors to these projects since larger the number of people that see the presentations, more they will learn and more stimulating will be to students that present because they can see all their work recognised.

Evaluation

Teacher should agree with students if their participation on the project should suffer an evaluation to the final note or not. Wherever the case, students projects should be evaluated or commented so students know that their effort was recognized. Usually, on a science fair, a jury evaluate the projects and the winners get a prize. In some cases this rewards are money or scholarships.

4. Rules and Student’s Indications

Along all the process, the teacher is responsible for the student’s supervision. Some indications from teachers are presented below:

Theme’ choice

Teacher should encourage student to select a theme that they most identify with it. Encourage them to talk with familiars, friends and professionals that in some way are related with the theme they choose. If necessary (normally is), teachers can recommend some bibliography, from books, magazines, internet... since students have the tendency of looking only on the internet and discarding the fact that not all the information there is scientifically correct.

Other important aspect is the project book where students keep note on all that is important: bibliography, discussions about the subject, results, conclusions... and teacher should help students to organize this precious instrument.

Obviously, a first discussion with the students, is always important, in order to organize the project.

In the case of students that have all the liberty of choosing the subject, it is important to see if the project is possible, not involving dangerous situations, materials that are not

possible to find,... and orientated on a way that have scientific interest and not only reproduce an experiment (that is a common attitude of the students).

Development of the project

This phase normally is the phase where students are more active into, since they experiment, propose hypotheses, and make their on conclusion. However, it is important that teacher discuss the project with the student, the results they obtain and what can be done to improve their projects or find alternatives if it does not work.

Presentation

Students have to prepare the presentation in a poster. To prepare the poster, it is important to help students on the selection of the information and on organizing it in an attractive way. The oral presentation should be trained with the teacher.

5. Conclusions

With this study we could conclude that science fairs are an activity that motivates and approaches students to science. A positive steady evolution on the number of participants on the science fair we organised along the last four years was noticed and positive results were obtained. A certain tendency of losing interest while growing older was unfortunately also noticed. To invert this situation it is important that these projects are part of the student's curriculum since they learn in a sense that is not possible on regular classes. With the first project, and improving thereafter all these proceedings become more familiar to students and teachers and the development of the projects become easier. It is also necessary that these activities make part of the curriculum of gifted students to allow their development and to improve their motivation and interest in science.

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