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"Olympic School Science Fair: Playful and Explanatory Hands-on Experimentation for Elementary School Students".

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Abstract. *Is it possible to involve all classes of the primary school in a science fair? What activities can be included in such a science fair and what results will be got? These are some questions we asked ourselves, as we planned to give a different direction to our school events, shortly before the end of the school year. We wished to devote our school festival to the presentation of students' educational activities, which had been created during the school season. In this presentation we report the main steps we followed, the scope of activities and a few results that surprised us.*

Keywords: Education, hands-on experiments, primary school, Science Fair

1. Introduction.

Our school, the 26th Primary School of Acharnes, located in the Olympic Village in Athens is in its fourth year of operation. The Olympic Village is a place, where in a short time span some ten thousand people of different origins were located, without there being any common vision or planning. The urban plan is modern, but there is lack of social infrastructure and activities that will give an outlet to the residents. Our school, that is co-located with the 29th Primary School of Acharnes, is attended by about 400 students aged between 6 and 12 years and has forty teachers of all disciplines. The school building was constructed to serve about 250 students. The excess pupils are housed in metal prefabricated classrooms.

We believe that under these circumstances the role of our school should not be limited to the narrow framework of learning, but it should be a link to the whole community. The school's role is to highlight the particular skills of the students, to provide more learning opportunities, to encourage students to play a more active role, to involve the most possible members of the school

community, in a climate of cooperation and mutual understanding.

Modern curricula emphasize the interdisciplinary approach of knowledge. Specifically, the science books, which have been introduced in recent years in primary education, promote the exploratory approach of knowledge with an emphasis on experimental procedures through teamwork learning.

One of the major problems reported in education [1] and especially in science teaching,[2],[3] is lack of connection of school knowledge with everyday life. As a result students' knowledge is fragmentary and limited to the school subjects. Therefore, students and citizens later, accept interpretations of phenomena that are not based on scientific knowledge.

Today we believe that the tools of digital technology if available in schools are useful in the educational processes at all levels of education. Especially in our school, there is a fully equipped computer lab which helps students, with their teachers' guidance, to learn how to seek and process information. Thus, computers are tools for everyday use.

Our school participates in the activities of the Network of Educational Innovation [4]. This collaboration provides us the opportunity to have greater freedom in the choice of our educational activities and methodological approaches.

On the occasion of the end of the school year, we promoted the idea of organizing a festival that would allow all students and teachers to participate in a process of reflection, search, organization and presentation of what they have learned with relation to science.

2. Methodology - Planning

Science fairs in schools are not new in the international arena, while similar initiatives have been developed by the Hands-on Science Network. In most Greek schools, such events are

infrequent, with a few exceptions [5] [6] and till today the Greek Schools' festivals at the end of the school year, usually include songs, dances and theatrical performances by students. When proposing to change this tradition there was concern about the realization and possible acceptance of a science festival.

The promotion of the idea and the interaction between teachers and students during the school year revealed new ideas, shaping and strengthening the spine of the event. It should be noted that we tried to involve all classes and teachers in the festival from their own perspective. Although the activities may have a different content for each class, there was a common method of approach according to the students' abilities and needs.

In all classes, the process began with students' questions, triggered either by issues arising from the textbooks, or by trying to understand and interpret natural phenomena, or environmental issues and technological applications. This approach is based on the inquiringly evolving educational model.

We urged students to express their own ideas/hypotheses and they were asked to seek information, to participate in the activities, which took place inside and outside the classroom and to carry out experiments from the schoolbooks. The idea of the science fair at the end of the school year was led to new ideas for different experiments or constructions out of simple materials.

The skills of observation, planning and organizing experimental procedures, control of apparatus, use of simple materials, interpreting experimental data, tracking and analyzing environmental issues and developing respective positions, were just some of the objectives we have set for our students.

In any case, we had no intension to impress with the presentation of the experimental procedures, but we aimed at participation and cooperation between the students, understanding and correlation between phenomena and concepts and our ultimate goal was development of attitudes based on addressing phenomena and situations of everyday life.

3. Description

The organization and choice of activities by so many classes, and students of different age and the participation of teachers with different interests, background knowledge and experience was not easy.

The spirit of collaboration, the need for renewed activity, the enthusiasm of the students in implementing these science related actions and their flexibility to adapt to whatever activity each class decided, allowed for the synthesis of a multifaceted image with common subject.

Specifically:

The younger pupils carried out environmental programs and actions related to marine species threatened with extinction. Specifically, they gathered information from the Internet, books and magazines. They created and presented material that included texts, poems written by themselves, photographs and paintings. They composed narrative videos, constructions, quizzes they played with their parents at school. The main focus of these actions was not only the environmental awareness, but the interdisciplinary approach of knowledge (fig.1, 2.)



Figure 1, 2 : Presentation of Environmental Programs

The students of the third grade collected utilities from the past that they compared with those of today. Furthermore, they distinguished the similarities and differences in their use, technological developments having occurred and changes in construction materials. Through this process, they discussed the changes that the technological development has brought into our lives, trying to move to the past in spirit and think of how their daily lives would be. Finally, they expressed their ideas about how they imagine the future. (Fig. 3)



Figure 3: Presentation of utilities from the past

The students of the fourth grade dealt with the issue of recycling. Specifically, they explored the possibilities and benefits of reusing materials and they identified the problems of waste. In addition, they made musical instruments and utilities with simple materials (fig.4), they designed and presented the "fashion of recycling," and finally they wrote and played a puppet show on the Protection of the Mediterranean.



Figure 4: Construction of recyclable materials

The students of the two major classes were very interested in science during the school year as this lesson was very different from the others. Students wrote, edited and handed out their journal of science to the school community. (Fig.5). In the science fair, they organized and presented experiments, using simple materials, by their own or with the help of digital technology that was available at the school. (Fig. 6)



Figure 5: The first page of the newspaper

The experimental procedures included units of the curriculum such as density, solubility, air pressure, solids, production and dissemination of sound, static electricity, simple electrical circuits, conductors and insulators, contraction and expansion of solids, liquids and gases, acids, chemical reactions / bases and cellular structures. Also others were added, based on the interests and concerns of students e.g. transmission of waves, microscopic structures, planetary system, motion of missiles.



Figure 6: Observations with the digital microscope



Figure 7, 8: Pupils' experimental procedures, using apparatus and materials



Figure 9, 10, 11: Highlights from the experimental procedure

The interaction between students was decisive for the development of our process. We have seen students cooperate even when disagreeing. Furthermore, common discoveries united them and gave them joy. (Fig 7-11)

4. Results

The process of organizing the festival of science at school, gave us some expected results and others that we were surprising.

The first point that impressed us, was that students with special learning or behavioral problems, participated in the activities. We were very pleased when we saw students that were diagnosed with learning difficulties, to take an active role. Not only had they gathered materials, but they also constructed experimental devices and

experiments. They were active members of their team, they took responsibilities and finally they gained the acceptance of their peers.

The students moved quickly to self-organization processes and between teams rivalry developed, for the better presentation of their activities.

That the students undertook to present their activities to their peers and to their parents was a very important experience which helped them to develop self-awareness and present and support their opinions. Children who had difficulty to express their views and just reproduced the answers from the textbooks, managed to interact with the audience, explain and answer questions that they hadn't been prepared for.

The transportation and the expansion of the educational process out of the school environment, gave a different dimension to the subjects of the school program. We met children who spent break time or their spare time at home, trying experiments with simple materials and presenting them to their classmates.

Our students encouraged us to proceed by trying to find answers and explanations to phenomena that they were not interested in before.

Parents participated actively, in many of the activities. There were parents who did voluntary work for the preparation and construction of the experiments.



Figure 12 Parents participate in classroom activities

During the presentation, the parents took the role of learners and students took the role of instructors. The students set their parents thinking, encouraged them to express their hypothesis, implement experimental procedures or activities together and reach conclusions. (Fig. 12)

The whole process left excellent impressions to all of us. Our school opened up to the community, young and old people participated in the same path of learning and reflection. The educational activities were not only confined to the classroom, but have been expanded into many areas of students' lives.

We believe that the science fair gave us the opportunity to promote and achieve objectives beyond the narrow framework of learning the lessons of science. The two schools worked extremely well and the students with their teachers enjoyed their involvement during the preparation and presentation of the festival.

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