# Broadcasting Science: a New Bridge between Science and Society

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Abstract. Science has many implications in our everyday lives, from scientific and economic topics to those related to health or the environment. However, society frequently does not appreciate the important role of science in our lives. Furthermore, the problem of science education is how to stimulate students, our future society. To solve this, it is necessary to make science understandable and enjoyable to students and everybody. Science has often been a topic in mass media news, from the printed word to radio and television. We feel that radio could easily be used as a diffusion instrument to give a new and balanced perspective of science to make it more interesting and more participative in the eyes of our pupils and teenagers. The main purpose of this article is to present our radio programs used to communicate and enjoy science to the primary and secondary school students and the whole of society.

**Keywords.** Improve science, Radio program, Science communication, Students and society.

## 1. Introduction

Science and technology are inside and around our lives, science teachers must especially show students that science is also in their lives. Here there are a few examples that relate science and life: nutrients digestion is produced by a lot of chemical reactions; electricity at home and the Moon around the Earth are attempted by physical laws; computers use mathematics; diseases like diabetes or sickle cell anemia (genetic disease) are studied by human biology and, science also comprises environmental and engineering fields. Almost certainly, today during your family lunch or your family dinner, some words about any field of science could be named or asked by children, deoxyribonucleic acid (DNA), genetic modified organisms (GMO), stars, energy, whale, etc., could suddenly appear. Despite of this children science interest, our society

frequently does not appreciate the important role of science in our lives. Why?

Probably because for a long time, scientists, science teachers, politicians and media did not give a real importance to science communication. Thus science has only lived in university laboratories and in the mind of researches, science is completely distant out of people's lives. Fortunately, it seems that things are changing and, nowadays is widely accepted the economic and social importance of the science communication to the public [1].

On the other hand, scientists and science teachers use different methods to involve students with scientific knowledge, for example they prepare science experiments (into the laboratory or by internet), visits to museums, industries, etc., and, sometimes with the help of magazines, films or radio programs.

Finally, the purpose of this article is to focus on how to improve science in primary and secondary school students and how to transmit science knowledge to the whole of society. At the end of this venture we will spread the importance of science to young students, families, friends and the public in general. For this reason we want to build bridges between science and society [2].

In this way, we analyzed the question "What should be done to appreciate science between young people and society?" and, we focussed the problem on making science popularization on a radio program, one of the different forms to presenting science to the public [3].

Another point that we have to pay attention for guaranteeing success in science dissemination is that science communication must present science in a pleasant and exciting ways to the public, is not easy to do it but our radio program tries to do it. The promotion of science among young people is crucial if we want to increase their interest in science [4 -6], so we have to educate them from a young age.

#### 2. A radio program

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To bridge the gap between primary and secondary school students and the scientific knowledge led us to design a radio program with science news, student's competition, the history of science and everything related to science.

From 1996 we have developed several programs about science and the history of science in an effort to present them with a new perspective to the students and society. These include "Badaciència - Bada-science" which began its emission in 1996 and finished in 2007 from the radio station RIA (Ràdio Isaac Albéniz) at the Isaac Albéniz secondary school in Badalona that it emits by 91.6 FM. The radio program "Juguem amb la Ciència - Playing Science" which began its emission in 1998 and finished in 2007 from the municipal radio in Sant Andreu de Llavaneres that it emits by 107.8 FM [7] and, finally, a new "Playing with Science" which is been emitting since 2007 in the municipal "Mataró Ràdio" that it emits by 83.9 FM, (all these cities are in the Barcelona area, Spain). The program format was similar in these three different broadcasting companies.

#### 3. A representative program

"Playing with science", is directed to the pupils of primary and secondary school education and it is developed as a space of scientific spreading that tries to involve young students and families into science. The program is on air twice a week, usually on Tuesday from 17.30 h to 18 h and also repeated on Saturday from 10 h to 10.30 h.



Figure 1 includes the program sections that we give explanation in detail. Each section starts with a different and suggestive introductory music.

#### 3.1. The "Program's presentation"

It is the introduction section of the program and it prepares the audience for each part of it. Participants and the main part of the program are introduced by the presenters. Figure 2 shows different student groups. On the left panel you can see primary school students, on the right panel two secondary school students and, in between, the "Matarò radio" trade mark.



## **3.2.** The news

In this section students present and discuss several news reports dealing with science in general.



The news stories are obtained from different mass media sources which the students selected and prepared for the day's program. The news reports cover topics from Physics, Chemistry and Medicine to Biology, Technology or Nuclear energy. Figure 3 shows a few news paper headlines presented during the last academic year (2009-2010), we always try to work on several science fields. Thus you can observe news from technological and scientific evolution to high cholesterol could course mental problems or from false scientific Myths to Barcelona opens Synchrotron.

### 3.3. The quiz.

Each student must respond to five questions. Each one of them is accompanied by three possible answers but, only one is the correct one. Frequently additional questions will be asked based upon students' answers. While not officially part of the quiz, these questions help to expand the discussion and review the students' knowledge and understanding of the subject matter.

Figure 4. 1 <sup>st</sup> QUESTIO	N: At what temper	rature does ice begin		
A <u>0°C</u>	B -10⁰C	<b>C</b> 100℃		
2 <sup>nd</sup> QUESTIO	N: The X-Ray was	discovered by?		
A Mendeleiev	<b>B</b> Lavoisier	C <u>Roentgen</u>		
3 <sup>rd</sup> QUESTION: Which of these animal is a mammal?				
A Penguin	B <u>Dolphin</u>	<b>C</b> Shark		
4 <sup>th</sup> QUESTION: How many groups of 2 people are possible with Mary, Laura, Peter and Jim?				
<b>A</b> 8	<b>B</b> 4	C <u>6</u>		
5 <sup>th</sup> QUESTIO has lost one elect	N: What is the narron?	ame of an atom that		
A Cation	Bisotope	C Anion		

Obviously, the score is different for each question, the easiest (the  $1^{st}$  question) is 1 point, the  $2^{nd}$  is 2 points and consecutively still the most difficult (the  $5^{th}$  question) that is 5 points. Figure 4 shows an example of a secondary school

student's questionnaire, the underlined answer is the correct one.

It is important to stand out that the questions never finish when the students guess the correct answer. Thus, all the answers, correct ones and incorrect ones, are analyzed and discussed in detail.

Accordingly, in the 1st question when the participant answered correctly we have to continue with the same question explaining that at -10°C the water freezes and at 100°C it boils and we could also ask them "What do you call the passing of solid water to liquid water?".

In the 2<sup>nd</sup> question we have to explain who was Mendeleiev and its periodic table of elements and also who was Lavoisier "the father of chemistry" because Röetgen discovered the Xray and we could also ask them "What is X-Rays used for?".

In the 3<sup>rd</sup> question when the participant answered correctly we have to ask what kind of group does the penguins (bird) and shark (fish) fall under and we could also ask them "What does mammal mean?".

In the 4<sup>th</sup> question participant has to count the possibilities of how many groups he can make using only 4 people and we could also ask them "Are there the same number of groups if you have to make them with 4 different letters a, b, c and d?".

And, finally, in the  $5^{th}$  question, the most difficult one, if the participant is wrong we have to help him/her to explain what is an isotope, cation and anion and we could also ask them "What is an atom?".

At the end of this paper there is an attachment with two more examples of questions for primary school (students 10-12 years old) and secondary school (students13-16 years old) in the same format as Figure 4. Furthermore, you can notice the different question levels, primary school are easier than secondary school questions.

## 3.4. The history of science

The evolution of science is discussed. Students introduce and present an individual scientist, such as Pasteur, Bohr, Einstein, (Santiago Ramón y Cajal and Severo Ochoa, both Spanish Nobel laureates), Fleming, Marie Curie, etc. Students and presenters have a discussion about life, technical findings and discoveries in scientist's living days [8, 9].

#### 3.5. Taylor's box

This section is used to explore together with participants many controversies that have taken place throughout the history of science, such as Phlogiston Theory, Spontaneous generation, Genetically Modified Organisms (GMO) or Heliocentric Theory, for instance.

#### **3.6.** To say goodbye

It is the section that finishes the program and thanks the audience, the participants and the radio personal.

Sometimes the program changes its format. Maybe two to four times a year some teachers and scientists are invited to this program and they can talk about things related to science. In this way, science teachers explain the changes in science curricula in schools. Scientists, from the same city or geographical area, try to explain their research in several scientific fields. In addition, this program supports the "Science Week" realized ones a year in Mataró city, with an interview to the organizers where they could explain the publicity of the activities for the event.

#### 4. Impact of the program.

After each years program, the opinions of the students and their teachers were assessed. The students considered that the program is an important experience.

Most of them appreciated the chance to perform on a radio program and the preparation of the dialogues that have increased their language and vocalization. All of this leads the participants to increase their communication ability. Therefore, most of the participants clearly showed a marked tendency to choose studies in which science constitutes a considerable part of the curricula.

Furthermore, primary and secondary school teachers, who have helped to promote our initiative throughout their direct contact with students, have received the program with great enthusiasm.

All of these programs have had a vital impact on science perception around the three cities mentioned before (Badalona, Mataró and Sant Andreu de Llavaneres), because most of the families and friends, from students who participated in this program, listened to it and followed it. This increase on science interest starts when the parents were listening to their children on the radio program and it continuous with friends and family members joining in to listen to them. At the end, most of the people were transformed into students' supporters and, of course, they also become science supporters.

### **5.** Conclusions

At the end of theses experiences we are able to guarantee that:

- 1. All secondary schools from Badalona, Mataró and Sant Andreu de Llavaneres have participated in the program and their families have followed them. This implies that science was disseminated to our society.
- 2. Students are able to better understand science and see the evolution of science.
- 3. Questions about science and its history during the program increases the knowledge of science in our teenagers and the public in general.
- 4. Last years, the amount of students who have chosen science curriculum in compulsory and non compulsory secondary school was clearly increased in these schools who participated in the program.

These programs have contributed to:

- 1. Increasing the reading, writing and oral presentations of students.
- 2. Showing the history of science to students and society in general.
- 3. Promoting critical and reflective discussions about the great controversies of our time. Reinforcing the affirmations that each student spills in the program and to know how to refute the opposite ideas.
- 4. Reinforcing the presence, interest and study of science in and out of the classroom.
- 5. Spreading the science advances its analysis and estimation.

The final objective is that the young people, our future society, incorporate basic scientific knowledge that in the future allow them to make their own decisions and to influence the resolution of scientific problems in a more technological society.

On basis of our experience, we recommend this initiative as an approach that teachers could apply in their science classes. It is better with a radio transmitter however, this is not essential because students could play the same role in primary or secondary school class that they could play in a radio program.

### 6. Acknowledgments

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# Annex.

PLAY SCIENCE (PRIMARY SCHOOL)				
1 <sup>st</sup> <b>QUESTION:</b> Water in normal conditions is liquid. Ice is solid water. What is the name of the process of liquid to solid?				
A <u>Solidification</u>	B Melt	C Liquefaction		
2 <sup>nd</sup> QUESTION: Which of these organs is part of the respiratory system?				
A Liver	B <u>Lungs</u>	C Heart		
3 <sup>rd</sup> QUESTION: What is the unit which scientists measure time with?				
A <u>Seconds</u>	B Meters	C Kilograms		
4 <sup>th</sup> QUESTION: Which material is less dense than water?				
A <u>Petrol</u>	B Iron	C Crystal		
5 <sup>th</sup> QUESTION: The scientist Dr. Severo Ochoa was an important biochemist. Which of these awards did he win?				
A <u>Nobel Prize</u>	B BCN City Prize	C The Lottery		

PLAY SCIENCE (SECONDARY SCHOOL)				
1 <sup>st</sup> QUESTION: What is the chemical symbol for lead?				
A Li	B AI	С <u>Рь</u>		
2 <sup>nd</sup> QUESTION: Who won two Nobel prizes?				
A Pasteur	B <u>Marie Curie</u>	C Roentgen		
3 <sup>rd</sup> QUESTION: What does (-2) <sup>2</sup> mean?				
A 4	B <u>0.25 (1/4)</u>	C -4		
4 <sup>th</sup> QUESTION: Which of these organelles does not have DNA?				
A Nucleus	B <u>Golgi system</u>	C Mitochondria		
5 <sup>th</sup> QUESTION: Rocks are formed by minerals. Which mineral can iron be extracted from?				
A Malachite	B Galena	C <u>Pyrite</u>		

PLAY SCIENCE (SECONDARY SCHOOL)				
1st QUESTION: What is the chemical symbol for lead?				
<b>A</b> Li	<b>B</b> AI	С <u>Рь</u>		
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<b>A</b> 4	B <u>0.25 (1/4)</u>	<b>C</b> -4		
4 <sup>th</sup> QUESTION: Which of these organelles does not have DNA?				
A Nucleus	B <u>Golgi system</u>	C Mitochondria		
5th QUESTION: Rocks are formed by minerals. Which mineral can iron be extracted from?				
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