
Getting High School Students Excited about Physics

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Abstract

The Laws of Physics are objective and may seem “cold” to some people. However, their presentation is subjective, and can vary from being “very boring” to “very exciting.” When the presenter enjoys Physics, has a passion for it, and sings as well as dances Physics in the wavelength, vocabulary and emotional domain of the students, they experience an enjoyable excitement and discover for themselves that “Physics is fun.” The author’s presentations in several Western countries testify to this. The experience of the author in August 2014 with 310 High School students from Mumbai, as well as the lessons from that encounter is presented in this paper.

Introduction

Physics was born at the dawn of creation, when our ancestors looked at the moon and the stars, and marveled at the beauty, harmony & wonders everywhere. Physics is just a serene contemplation of Mother Nature – the beauty, truth and power in her. As Zukav [1] puts it: “Physics, in essence, is simple wonder at the way things are, and a divine interest in how that is so. ... Physics become pure enchantment.” In 1934, Einstein spoke of his “rapturous amazement at the harmony of Natural Law” in his book, “The Religious Spirit of Science.” How do we communicate to the world the real Physics i.e. Zukav’s ‘pure enchantment’ and Einstein’s ‘rapturous amazement’?

The Problem

In every country in the world, it is not unusual to hear comments like: “Physics is hard. Physics is boring. I don’t like Physics.” If Physics is ‘enchanting’ to Zukav (who is not a physicist), how does it become ‘boring’ to the students in Colleges and Universities? More than 35 years of experience of the author in Teaching, Research and Outreach in 4 continents has revealed that the poor communication skills of the Physics teachers, as well as the fun-focused materialism of the modern world, play a major role in the formation and growth of the prejudice as well as the brainwash, that Physics is hard and boring.

The Solution

On the positive side, the author has observed the following in his Physics Outreach in Belize (Central America), Grenada (West Indies), India, Jamaica (West Indies) and Trinidad (West Indies): “The younger students in High Schools don’t have such prejudice. They enjoy Science/Physics and are very open to it.” Hence, while getting the brain-washed grown-ups excited about Science/Physics is a difficult job, requiring a lot of time & money, doing the same for the High School students is an easy job. Further, the curiosity and inquisitiveness of the younger ones are worth comparing with the words of Einstein [2]: “I don’t have a special talent; only a passionate curiosity.” This reveals the enormous potential of any country, hidden in its High School students. Indeed, any country’s future Einsteins are right there in its High Schools – waiting for their ‘child-like curiosity’ to be fanned into an ‘Einstein’s passionate curiosity’.

The “Interactive Show on ‘Physics/Science Is Fun’ ” is an attempt in this direction. It follows faithfully the words of wisdom of the Director of Public Affairs of the American Physical Society, Michael Lubell [3]: “Establishing an emotional connection is an essential precursor to communicating serious information. Lighting up the amygdala gets the rest of the human brain to pay attention.” Thus, in the Interactive Show, attention-grabbing, toy-like demonstrations are used in a highly active and interactive way to create a sense of ‘wonder’. This is followed by a simple, Physics-based explanation. The students go through ‘an intense immersion experience in Physics’. They come out with an enjoyable excitement and the discovery that Physics is fun.

Special Practices

The philosophy of the Show is summarized in the mantra: “*Taste and see that ‘Physics is fun’.*” The focus is on ‘tasting’ – and not on ‘reading’,

‘hearing’, or ‘seeing’; not even on ‘learning’. Everything is adjusted so as to enable the students to ‘taste’ Physics and to experience Zukav’s ‘pure enchantment’ and Einstein’s ‘rapturous amazement’. The following steps are helpful in achieving the above:

- i) The class size is kept small, around 30 students at a time, to facilitate close interaction.
- ii) Every student is given a chance to come to the front of the class for some activity.
- iii) During the activities, the students are given the freedom to touch, feel, play, talk, explore, discover, experience, enjoy, exclaim, ...
- iv) The presenter is a passionate lover of Physics.
- v) He/she moves around, getting close to every student at some time or other.
- vi) He/she bubbles with an infectious enthusiasm and boils with explosive energy.
- vii) He/she sings, dances and tells stories in the wavelength and vocabulary of students.
- viii) He/she dramatizes things, whenever possible

High School Children in Mumbai

In August 2014, the author was invited to conduct the Interactive Show to 7 Divisions/Sections of 6th Standard students in Gokuldham High School, Mumbai. Each Division had 45 – 50 students. Since it was difficult to split the Divisions into Sub-Divisions, the Show was conducted for two class-periods (60 minutes) to one Division at a time. 305 students completed the Evaluation Form. The results are summarized in Figures 1 to 3, where percentages less than 10 are given correct to a decimal.

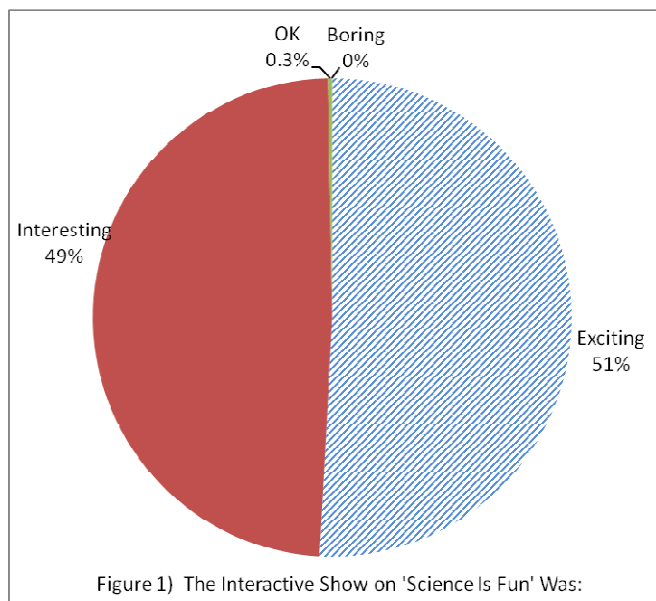


Figure 1) The Interactive Show on 'Science Is Fun' Was:

Figure 1 shows that 51% of the students found the Show 'Exciting', and another 49% 'Interesting'. Only one student (0.3%) had ticked 'OK', while no one found the Show 'Boring'. This confirms the earlier statement that the younger ones are not contaminated by the prejudice that Physics is hard and/or boring.

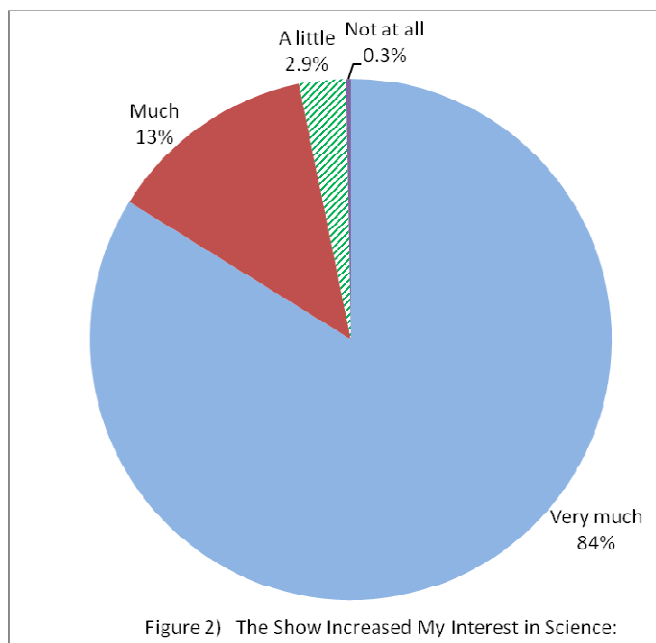


Figure 2) The Show Increased My Interest in Science:

Figure 2 is a check on whether the Show increased the students' interest in Science/Physics. 84%

have ticked 'Very much' and 13% 'Much' – totaling an impressive 97%. This is a verification of the following words of Alan Chodos[4], Associate Executive Officer of the American Physical Society: "If we could get members to go to K-12 schools and levitate a magnet or something, we really think these efforts would bring great rewards." Further, 97% of the students have mentioned that they would recommend this Show to their friends. All these reveal the enormous power and potential of the Interactive Show to fan the 'child-like curiosity' of the students into an 'Einstein's passionate curiosity'. These show that, with proper guidance, the Indian students are capable of winning the Nobel Prize in Physics, when they grow up.

In the earlier questions, the students tick one of the answers given. In the final question, they are requested to describe the Show in their own words. The response is summarized in Figure 3. The top 4 responses are: 'Very Interesting' (30%), 'Educational' (18%), 'Exciting' (17%) and 'Fun' (14%) – totaling 79%.

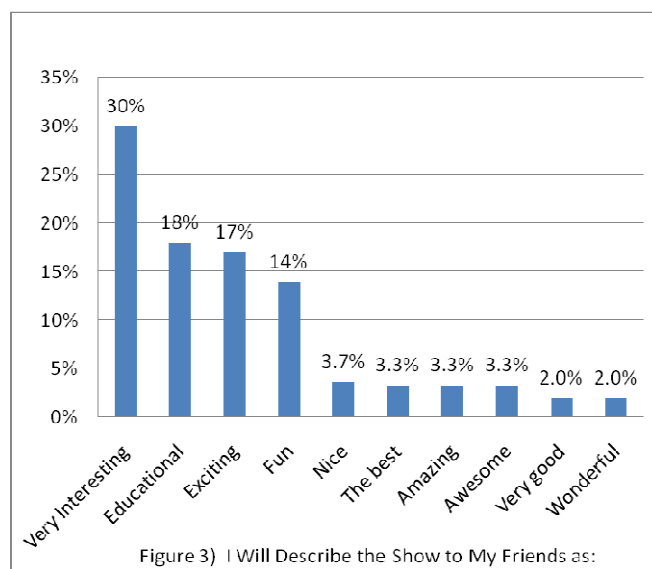


Figure 3) I Will Describe the Show to My Friends as:

This proves that Science education can be very interesting, exciting and fun-filled – at least at the early High School level. The next 6 responses are: Nice, The best, Amazing, Awesome, Very good

and Wonderful. Other descriptive words are: Cool, Fantastic, Fabulous, Great, Memorable, Mind-blowing, Outstanding and Superb. The interesting statements below are also found among the responses:

- The Show was very interesting & it increased my interest in Science. (111 students)
- I liked/loved the Show very much. (69 students)
- It was a very exciting Show. (39 students)
- I enjoyed the Show very much. (29 students)
- I thought that Science was boring. Now I know that it is interesting. (24 students)
- I never thought that Science was so interesting. (19 students)
- It was the best Show I have ever seen. (16 students)

India on Top of the World

During the Show, the presenter/author tells the students that it is time for India to become 'Number One in the World', and invites them to work together for turning the 21st century into the 'Indian Century'. The following statements from 3 students affirm that India will become Number One soon: i) The Show was very interesting. In fact, I don't have enough words to describe it. I always disliked Science; but from now on, I love Science, and I want India to be no. 1 in the world." ii) It was an amazing experience. The uncle was very nice. I loved the experiments. They were very interesting. I am sure we will see our India at no. 1 position very soon. iii) I would like to become a scientist and help India to be 'Number One in the World'.

Conclusion

The Laws of Physics are very objective, and hence may appear cold to many people. However, the presentation of these can be very warm, lively, passionate – and even dramatic and poetic – if the presenter has a passionate love for Physics, an infectious enthusiasm and expert communication skills. The poet Lord Byron [5] is right when he said: "There's music in all things" – including Physics. Kenneth Laws [6] says that 'dance' is full of Physics. More interesting is the fact that Physics is full of dance – the dance of the electrons around the protons, the dance of the atoms in the vibrations of solids, the dance of the Earth around the Sun, etc. It is a great privilege to communicate the music, the dance, the drama, the wonder, and the excitement in Physics to the students. The younger ones in the High Schools have not been infected by the prejudice that Physics is hard and boring. They are very curious and open-minded. Physics Outreach to this age group takes much less time and money than to those in Colleges and Universities – and yet yields much better results. Enabling the younger ones in India today to "taste and see that Physics is fun" may well be the royal road to getting more Nobel Prizes in Physics in the future.

References

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