Chilean Children Take a Voyage of Light

Rodrigo A. Vicencio

In 2008, an optics professor at the University of Chile and ten pedagogy students began work on a program to educate elementary school children about light and optics. A marvelous voyage had begun.

Boys playing with a periscope (right) and a camera obscura (below).

Courtesy of Rodrigo Vicencio

Our journey began when I, an optical soliton researcher at the University of Chile, invited my optics students to apply for a grant to promote science within Chilean schools. We targeted elementary school children around 9 years old because we wanted our experience to emphasize play and the fun of exploration. The project was intended to help kids to explore optics and the characteristics of light with games and experiments.

In developing materials and activities, the group emphasized simple but innovative experiments that children could reproduce on their own. This enabled the children to be the protagonists in their own learning experience. Experiments included recyclable and low-cost materials that were easy to mount. We constructed camera obscuras from potato-chip tubes and a homemade laser with a paper towel tube. The workshop activities were divided into five 90-minute teaching modules that were taught once per week.

In March of 2009, we produced experimental kits that would be used in the workshops in six selected schools of central Chile, mainly in Santiago. We wrote a project manual that included a theoretical introduction to the learning modules and the steps to follow in each activity. The experiments were supported with videos in which the hands of a mime showed the children how to put together the experimental kits. The video helped to attract the kids' attention and to engage them in each experiment.

As part of our dissemination plan, we designed motivational posters related to each module. Participating teachers were asked to display the relevant poster in their classrooms before a new topic was introduced. We produced a DVD that included all of this audiovisual material and gave it to each participating teacher for free. We also created a website that contains the project content—www.elviajedelaluz.cl.

Step-by-Step: How to Make a Camera Obscura

Materials

- ✓ 1 potato-chip tube cut into two parts, including its opaque lid.
- ✓ 1 pair of scissors
- ✓ Electrical tape

Procedure

1. Make a small hole in the middle of the metal bottom of the tube.
2. Close the shorter piece of tube (the one with the metal bottom) by fixing the lid with tape.
3. Take the larger piece of tube (~15 cm) and build up the original tube, putting it on the lid and fixing it with tape.
4. Place one eye in the open part of the tube and block the light with your hands. Look to any bright place and surprise yourself!

Courtesy of Rodrigo Vicencio

Kids having fun with optics at the university.

Before we began working with selected schools, we offered training sessions for teachers.

Our objective was to make the instructors active participants in the workshop rather than passive spectators. The training gave them a chance to familiarize themselves with the experiments so that they could teach them with confidence. The teachers' dedication was critical to the success of the program. For example, the task of dividing the class into appropriate work groups required a previous knowledge of the students that only the teachers could provide. Teachers were also able to control discipline in the classroom.

After four months of preparation, we took "The Voyage of Light" to the schools. Two members of our group attended each class, plus the head teacher. The project team was excited and nervous because we did not know how we would be received. In one exercise, which began with a discussion of rainbows, the class monitor asked: "Do you think you could create one?" and "Do you want to describe one?" They all responded, "Yeeees!" But, until they did the experiment themselves, said the class monitor, "they never could imagine how beautiful it is to create a rainbow. Some (the most creative ones) imagined the universe and in the center the sun; they even saw stars and constellations. Ah, kids!"

We were gratified to see that the students did not want to end the experiments in order to take our survey evaluating the program. In some sense, it meant having to end the fun and begin a more traditional system of teaching. Probably the most important memory that will stay with the children will not be specific scientific concepts or optics laws, but rather the sense of fun they had while conducting science.

Throughout the year, we overcame many challenges. We realized that it is necessary not only to involve the teachers, but also higher school authorities in order to generate total buy-in to the project. We did not have problems with getting the children to perform the experiments because they were highly motivated. We believe that the involvement of the head teachers was critical to getting and keeping high student motivation.

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We asked the children to write down what they had learned during the workshops. With this task, we realized that our project had soaked in more deeply than we could have imagined. Some phrases were: "Now I like science better than soccer;" "I learned that the project was sensational and I liked all the experiments;" "I learned to share with my classmates;" and "I learned that you can do anything."

We concluded the project with an original play that was created to reinforce the content that was taught throughout the workshops. The kids were very receptive. Our intention was to leave them with a lasting impression of what they had experienced in order to maintain their positive thoughts toward science. We hope that we have motivated some of our kids to learn by posing questions and enabling them to search for their own answers. Throughout 2010, we will continue our voyage with other kids.

We are grateful to all those who collaborated with us and made this voyage a reality, especially Explora-Conicyt, GTD Internet, MIM and the science faculty at the University of Chile.

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