



## **Awareness and knowledge on the Ozone Depletion and its outreach program**

Y. Tsubota

J. F. Oberlin University, Natural Science Divisions, Atmospheric Science, Tokyo, Japan (tsubota@obirin.ac.jp)

### 1. Introduction

We have been running one-day summer seminars on ozone depletion since 2009. More than 60 high-school students attended these seminars. We assigned pre- and post- seminar questionnaires covering the awareness and knowledge of ozone depletion and ultraviolet radiation to these students.

The Japan Society for the Promotion of Science (JSPS) has supported our seminars under the 'Feeding Fruits of Scientific Research Back into Society' program. The aim of the program is to promote science study and ultimately to advance research by stimulating the intellectual curiosity of these students while cultivating their sense of creativity and awareness of science's cultural value and societal importance.

### 2. Objectives

The purpose of our seminars is to promote science study and ultimately to advance research by stimulating the intellectual curiosity of the young participants while cultivating in them a rich sense of creativity, along with a keen awareness of science's cultural value and societal importance. Our one-day seminars are part of our climate-change education. Our concrete objectives are:

- to understand ozone depletion science;
- to understand the consequence of ozone-depletion;
- to enhance their understanding & appreciation of scientific research;
- to appreciate the international approach to global environmental-issues; and
- to understand science's relationship with society.

### 3. Contents of our one-day seminar

We try to keep our lecture brief; and hence, the lecture is embedded within three blocks (i.e. experiment, observation, and simulation). The first block is a lab activity that produces ozone via UV radiation and destroys ozone via injection of chlorofluorocarbon CFC into an experimental chamber. The second block is an in-situ field UV measurement where the students confirm the difference between UV-A and UV-B radiation strength and hence the effects of the ozone layer. Also, they determine the quality of sunscreen lotions and UV-restricting sunglasses. The third block is a computer simulation of future ozone concentrations in the stratosphere. The using a computer model of ozone concentration, students are expected to grasp the global view of the ozone issues.

### 4. Awareness and pre-knowledge of our students

Our students were not familiar with ozone-depletion science nor about any international action concerning the ozone layer as the pre-seminar questionnaires had revealed. For example, more than 40% could not distinguish ultraviolet from infrared radiation. More than 40% did not know the catalytic reaction of ozone depletion due to chlorine radicals released from CFCs by ultraviolet radiation. Fewer than 30% were aware of the international cooperation to establish the Vienna Convention for the Protection of the Ozone Layer and the UNEP Montreal Protocol. And fewer than 40% were aware of the industrialized and developing countries sharing the responsibility for protecting the stratospheric ozone layer. Considering the national school curriculum in Japan, these results are because of not covering the ozone-depletion in science and any other subjects.

### 5. Effect of our one-day seminar

The results show that our seminars do have positive effects on the understanding of ozone-depletion science, but the individual responses were not as simple. We found that some students changed their correct selections to wrong ones on the post-seminar questionnaires. We concluded that our outreach program has an effective measure of dissemination; but careful instruction and text should be prepared for more-effective results.

Our one-day seminars were also evaluated using students' questionnaires that have been prepared by the Japan Society for the Promotion of Science. Results indicate that an interesting seminar may not always intensify participants' interest in science. Also, the results indicate that an interesting seminar may not always enhance a student's understanding on the subject. Moreover, those who answered the questionnaires as 'very interesting', did not show an intent to attend a similar seminar. And the answer to the question of 'Do you want to be a scientist' were varied.

Based on the results of the questionnaires, the contents of our one-day seminar were reasonable and adequate for high-school students. Our seminar objectives are confirmed by reviewing the statements of the participants as follow:

"I learned new knowledge and was made aware of environmental issues. Also, field measurements of UV radiation had enhanced my understanding of ozone-depletion science".

#### Appendix: Questionnaires prepared by JSPS

No.1: How was the seminar?

- a. very interesting
- b. interesting
- c. not interesting
- d. can't judge

No.2: Were the contents of seminar easy to understand?

- a. very intelligible
- b. intelligible
- c. unclear
- d. can't judge

No. 3: Did science interest you?

- 1. Science interested me very much.
- 2. Science interested me some how.
- 3. Science did not interest me at all.
- 4. I can't judge.

No. 4: Do you want to be a scientist?

- a. definitely
- b. if possible
- c. not really
- d. can't judge

No. 5: Do you have an intension to attend the similar seminar?

- a. definitely
- b. if possible
- c. not really
- d. can't judge

#### Acknowledgments

The authors offer special thanks to Dr. Noritaka Ktatani and Dr. Atsushi Mori for assisting science camp implementation. This work is partly supported by Grant-in-Aid for Scientific Research (C) No. 19500757 and 22500820, the Japan Society for the Promotion of Science.