

The General Atomics Education Program "Scientist in the Class'room

The General Atomics education program "Scientist in the Classroom", now in its third year, uses scientists and engineers to present "Plasma, -the fourth state of matter," to students in the classroom. A program goal is to make science an enjoyable experience while showing students how plasma plays an important role in their world. A fusion overview is presented, including topics on energy and environment. Using hands-on equipment, students manipulate a plasma discharge using magnets, observe physical properties of liquid nitrogen, and use an infrared camera to observe radiant heat ener@everal program benefits are: it costs less than facility tours, is more flexible in scheduling, and is adaptable for grades 2-adult. The program has doubled in coverage since last yearwith over 2200 students at 23 schools visited by 11 engineer/scientists. Increased prarticipation by the DIII-D staff in this program has been achieved by enlisting them to bring the program to their children's school.

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General Atomics-

Scientist in the Classroom

Introduction

Scientist in the Classroom is a GeneraltAmics
 Education program that brings a science professional
 and plasma physics demonstration equipment to the
 classroom to give students a hands-on experience of
 plasma and some of its characteristics. The program
 allows physicists, engineers, and technicians to share
 their experience and knowledge with students during
 a classroom visit. The topics presented are related to
 plasma physics and fusion technology and include
 discussions of fusion energy research status,
 environmental issues, magnetism and electricity
 ...and more.

Plasma Science opics are Aligned with Fundamental Education Standards

- Matter and its building blocks:proton, electron, and neutron
- Electrical charge and electrical character of materials
- Magnets and magnetic fields and their behavior and interaction with charges
- Extreme temperatures and their effects on different states of matter
- Electromagnetic spectrm from DC to X-rays
- Barometric pressure and vacuum
- Density effects on molecular mean free path in gases
- Different forms and transformations of energy

Scientist in the Classroom: Highlights of a Plasma Outreach Program A. Nagy, Princeton Plasma Physics aboratory R.L. Lee, General Atomics

Fusion Science and Chnology Topics Presented in the Classroom:

Different levels of the following topical areas are presented to students in Grades 3-12

- Definition of fusion/plasma
- Presentation on plasmapplications and fusion reseach
- Environmental aspects of fusion energy production
- Global warming effects of fossil fuel use
- Comparison of fusion characteristics with those of other energy sources
- Projected energy resource availabilitigend how fusion fits into humanity's future
- Engineering challenges associated with a fusion device are reviewed, i.e. vacuum chamber design, magnetic coil function, machine support structure, and material heat transfer considerations
- Several plasma diagnostic techniques are discussed covering density current, position, composition, and temperature measurements







Visiting Classroom Scientists, ours, and Internships How do they compare?

Aspect	Scientist-in the-classroo	- Facility tour	Summer stude	ents
Material modification	On the fly	Standardized	d N/A	l
Presentation s	iteAt the schoo	I Fusion facili	ty Fusion facilit	y
Students reached/day	150	50	1-3	l
Manpower required	1	5	1	l
Duration student perspe	Presenters pers 1.hour/student/v ective	pective Ashours/student	/tour/tour/day student	/
Man hours/da	y 6	20	4-8	L
Student transportation	None	Bus	Car (individua	al)
Monetary cost to school	s None	None	Student stipe	nd
Pre-program requirements	None	Teachers sh videotape, do part of notebo	ow someNone pok	

While the tours are very informative and a useful learning tool, they cost over twice the number of manhours than the classroom visits. The classroom visit is also easier for the teachers.













Classroom Visits by Month

There is a tendency by teachers to use this program as an enrichment especially toward the end of the school year shown by the chart peaks below greater number of presenters and a formal scheduling effort will help spread out this demand throughout the year **Number of Visits**

(0	2	4	6	
Dec-98					
Jan-99					
Feb-99			98-99 School Year		
Mar-99					
Apr-99	-				
May-99					
Jun-99 _					
Jul-99			Sumn	ner	
Aug-99					
Sep-99					
Oct-99	-		99-00 School Year		
Nov-99	-				
Dec-99					
Jan-00					
Feb-00					
Mar-00					
Apr-00					
May-00					
Jun-00					
Jul-00			Sumn	ner	
Aug-00			Juill		

Pictures are courtesy of the following San Diego area science teach Anitra Scotese, Westhills High School Casey Currigan, Marston Middle School Amelia Cacho, Elementary Institute of Science

Program Statistics

The number of school visits, students, and presenters more than doubled this past year, a sure sign that this program's popularity is growing. This year, scientists were encouraged to present to their children's classes, which brought more presenters into the program. Our records show that the expeditures of this program are about .1 presenter-hour per student, with a slight decrease in 99-00 due to the increase in scientist participation.

School Year	98-99	99-00	Ratio (%)
Schools Visited	11	23	+ 209%
Presenter Days	15	35	+ 233%
Kilometers Driven	500	650	+ 130%
Manhours	120	280	+ 233%
Students Visited	1090	2332	+ 213%
Students / Presenter-hour	9	8	-1%

Summary

The 99-00 school year program growth is the best indicator of its popularity and success. This year more repeat calls are starting to fill up the calendar another sign of programmatic success. This yearplans are to enhance coverage by continuing to expand the number of presenters, and setting up a schedule with weekly limits on the number of school visits.

Future program additions might include: continued hands-on demonstration development, development of a fun game presentation type style, and addition of a dedicated transportation vehicle.

And finally....

This plasma outreach program is an enrichment for the students and succeeds because students are always excited about learning first hand, using hands-on equipment to exploring the 4th state of matter--plasma ----in the classroom. Scientists enjoy the wonder in the students' eyes when students are presented with this fascinating subject. Science teachers are interested in hearing new topics and showing students how classroom learning is applied in the real world.

The Scientist-In-the Classroom program works very well as a science enrichment/demonstration outreach tool.

Everyone involved in the magical process of discovery grows.





