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December 13, 2011

Dr. Jim Lochner
Technical Officer
NASA Headquarters
300 E Street SW, Suite: 5U76
Washington, DC 20546
James.C.Lochner@nasa.gov

Dear Jim,

I am pleased to provide you with our progress report for NNX11AF10G, *Energy from the Sun – in Space and on Earth*. This report is for the period 2/14/2011-12/13/2011. Our independent evaluator reports are also included in the Appendix. Please contact me at (510) 643-5669 if you have any questions.

Sincerely,

Ruth Paglierani

Ruth Paglierani, Principal Investigator

Cc: Grants Officer, NSSC-contactcenter@nasa.gov
UCB Sponsored Projects Office, David Weldon
SSL Contracts and Grants, Janet Cooks
SSL Accounting, Ivy Lai

Introduction

Our objectives for *Energy from the Sun—in Space and on Earth* are as follows:

1) Train teachers in California using existing, high quality, standards-aligned heliophysics E/PO materials
2) Increase student interest in STEM careers through contact with science undergraduates and scientists
3) Partner with utilities to integrate heliophysics content into utility-sponsored trainings
4) Leverage solar school networks to bring NASA materials and programs to a new audience of educators.

Our key deliverable for *Energy from the Sun—in Space and on Earth* is a model of teacher professional development that integrates solar energy with heliophysics content. In three years, our fully-tested, mature workshop model will be ready to expand to schools studying solar energy nationwide, as well as to other NASA missions seeking a means of integrating solar energy into their E/PO efforts. We expect our workshop to be reproducible by heliophysics E/PO personnel working or planning to work on other NASA-funded programs. We will also provide the heliophysics community with access to our partners' expertise and their connections throughout California and the United States.

Below we describe the activities which helped us achieve our objectives this year.

1) Train teachers in California using existing, high quality, standards-aligned heliophysics E/PO materials

Over 80 teachers registered for our first Energy from the Sun workshop. We attribute the level of interest to the topic of solar energy, the quality of the instructors, and classroom materials provided to participants. In order to provide in-depth instruction to teachers, as well as substantial classroom materials, we limited the summer workshops in size.

The workshop content featured the following NASA Heliophysics Curriculum :

- The Real Reason for Seasons
- Exploring Magnetism
- The Electromagnetic Spectrum
- Eye on the Sky
- Living with a Star

Teachers wire solar electric circuits.

- Science of the Sun

2/3 of the teachers indicate that they will use the topics/materials as "an integral part of my basic curriculum," with all teachers planning to use the activities as a supplement to their basic curriculum.

Most teachers plan to share the activities with 1-6 colleagues. Three teachers anticipate sharing the activities with 15-20 colleagues.

The following were some answers to the question, "Did you come away from this two-day workshop with a new idea or new strategy that you want to include in your classroom practice? If so, can you describe your current thinking about this idea or strategy?"

- I now have a stronger knowledge base regarding magnetism, solar energy, transformations of energy, the sun, the earth's magnetism. [Elementary School Teacher]
- Definitely will use activities for introducing magnetism, electromagnetic spectrum/light, reasons for seasons. [High]
- The "connection" between magnetism, electricity and the sun/earth is so important and will help reinforce learning on all these "topics" for students. [Elementary]
- Yes! I will definitely use the energy transformation labs with my 6-7th students and the solar energy with high school and middle. Will also have these students teach to younger grades on campus. [Middle/High]
- Modeling sun-earth-magnetosphere relationships with lights, balls, wires to show relationships in 3D space. Using compasses to map magnetic fields on paper useful to visualize the invisible. [Middle/High]

A solar energy demonstration by Barry Scott.

NASA Heliophysics workshop presenters included Dr. Bryan Mendez (Science of the Sun, Exploring Magnetism); Kyle Fricke (The Real Reason for Seasons, The Electromagnetic Spectrum, Living with a Star); Ruth Paglierani (Eye on the Sky).

The solar energy workshop content was taught by experts in the field. Barry Scott, from the National Energy Education Development organization, taught the solar energy content for the Berkeley workshop. Hal Aronson, from WeCare Solar, taught the solar energy content for the Sacramento workshop.

Both educators are well-known and respected in the field of solar energy education. Barry's approach is based on piloted classroom materials through NEED. Hal's approach is more project-oriented and has been piloted over two decades throughout California. Hal recently was awarded the 2011 Tech Award for his humanitarian work supplying solar powered electric systems to health facilities in regions without reliable electricity.

Hal Aronson, one of our Energy from the Sun solar energy presenters, was honored for his humanitarian work at the 2011 Tech Awards.

The quality of our workshop presenters was noted in the workshop evaluation:

"This was the best teacher workshop I have ever attended. I loved the balance of high-level background science ed./info for teachers and experience with student labs. So much was presented but it did not feel rushed. Excellent planning and time management. Very calm and knowledgeable and entertaining presenters. Can't think of any suggestions."
[Middle/High Teacher]

Ruth Paglierani and Karen Meyer also presented "*Explore the Sun and Solar Energy with Ready-to-Go Activities for the Elementary Classroom*" on Saturday October 22, 2011 at the *California Science Teachers Association conference*. We presented hands-on science activities created especially for the elementary classroom. Despite the early hour and a conflict with the Awards Breakfast, over 40 teachers enthusiastically participated in our session, and provided us contact information for future workshops.

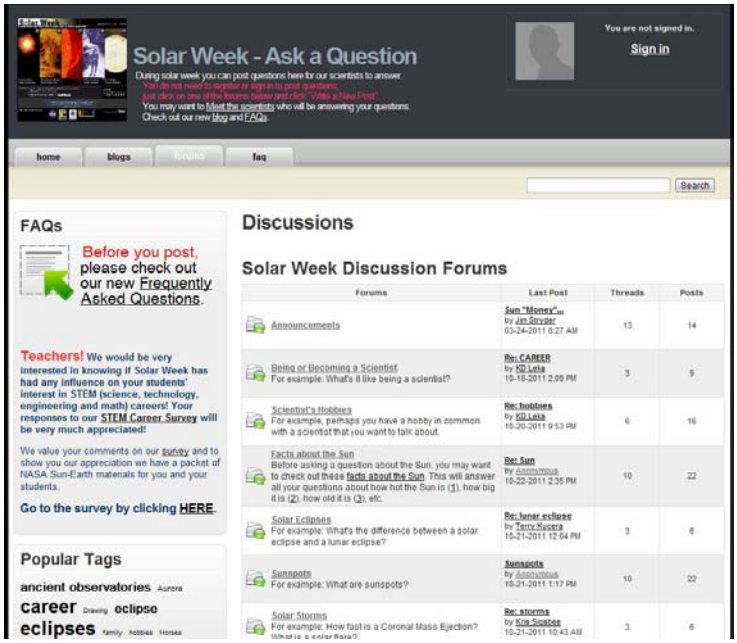
2) Increase student interest in STEM careers through contact with science undergraduates and scientists

a. Cal Day Career Panel

Cal Day is UC Berkeley's Open House, and the only day in which the Space Sciences Laboratory is open to the public. The Center for Science Education has participated in Cal Day for many years, coordinating presentations by scientists, tours of the Mission Operations Center, clean rooms, and other areas of interest.

As part of the "Energy from the Sun" project, we coordinated a "Cool Careers in Space Science" panel discussion. This was the first time this was offered as part of SSL's Cal Day discussion. It was well attended, filling the room. The panel included a UC Berkeley undergraduate who works at SSL, a space physicist, and several science

educators. Visitors reported learning new things from the career panel, with the main request for the future to have more space scientists on the panel



Screen shot of Solar Week bulletin board.

b. Solar Week
www.solarweek.org

Every fall and spring since 2000, Solar Week has provided a weeklong series of Web-based educational classroom activities and games geared for upper elementary, middle and early high school students with a focus on our dynamic Sun and its effects on Earth. On the curriculum/activities side of the website, students learn about solar eclipses, sunspots, solar flares and solar storms through a series of activities, games, and lessons. 45 minute lesson plans are available for each day. There is also information for kids wondering what it's like being a scientist, and pondering possible career choices.

After doing the activities, students can interact on the bulletin board with leading scientists at the forefront of Sun-Earth research by posing questions of them that are answered throughout the week. Questions are about the solar facts, phenomenon and events, and also about being or becoming a scientist. Solar Week was initiated as a means of encouraging girls in the sciences, and one of its strengths is a role model genders are welcome.)

October 19-22 was a successful run for Solar Week, this twice-yearly week of Sun-related middle school curriculum, activities, and an interactive message board with leading solar scientists. Statistics are as follows:

- Individual page requests (hits): 101,795
- Distinct IP addresses: 1,788 (the number of unique, unduplicated computers that visited the site at least once).
- 121 posts (questions from classrooms and answers from scientists) appeared on the interactive bulletin board. The students are always excited to get this personal attention to their questions about the Sun and about being or becoming a scientist.

3) Partner with utilities to integrate heliophysics content into utility-sponsored trainings

The Sacramento Municipal Utilities District (SMUD) partnered with us in Summer '11 to host our Sacramento-area teacher workshop. This workshop was advertised by SMUD to their extensive network of educators. SMUD provided a beautiful site in which to have the teacher workshop—with top notch workshop facilities, solar energy exhibits, and great food, which they provided as the host site. In addition, their Education Specialist, Suzette DelBono, presented on the popular topic of solar cooking. Her presentation was entitled "How to Cover 75% of California 6th Grade Science Standards through Solar Cooking."

4) Leverage solar school networks to bring NASA materials and programs to a new audience of educators.

We utilized SMUD's network of educators, as well as NEED's network of educators to advertise the workshop. Our Summer 2012 workshop is being included in SMUD's calendar, mailed to over 10,000 service region customers. Working with these partners is enabling us to reach large numbers of teachers.

Deliverable

Our key deliverable for Energy from the Sun—in Space and on Earth is a model of teacher professional development that integrates solar energy with heliophysics content. Our two workshop models differed in the solar energy content as well as in the follow-up workshop agenda. Our work this year deepened our understanding of teacher needs around this topic. We will work with a focus group of teachers in FY12 to modify our workshop models based on our formative evaluation results and input from our focus group of teachers. We anticipate experimenting with new content, kit materials, length of workshop, and alternate ways of integrating heliophysics with solar energy in order to optimize our end results with teachers and their students.

Appendices

A. Evaluation of Berkeley 2011 Energy from the Sun workshop series

B. Evaluation of Sacramento 2011 Energy from the Sun workshop series

Summary of results
Energy from the Sun Workshop
Berkeley – June 28-29, 2011

Overall, participants considered this workshop to be a high-quality professional development experience and leave eager to use what they have learned in their classrooms. Participants commented on the excellent and knowledgeable presenters, the high level of information and variety of ideas presented, and the excellent planning and organization of the workshop. Two comments from teachers worth highlighting follow:

> *"Thank you for a very well-planned and executed workshop. I am now inspired to continue exploring and sharing my newly gained information!"*
> [Elementary Teacher]

> *"This was the best teacher workshop I have ever attended. I loved the balance of high-level background science ed./info for teachers and experience with student labs. So much was presented but it did not feel rushed. Excellent planning and time management. Very calm and knowledgeable and entertaining presenters. Can't think of any suggestions."*
> [Middle/High Teacher]

Further conclusions inferred from the survey responses are as follows:

- Fortunately, this was not a one-size-fits-all workshop. A range of activities and ideas were presented to participants, and they appreciated being able to take from it what they could, depending on their teaching situation.
- While the workshop worked well, overall, for the wide range of teachers from different grade levels, the elementary teachers seem more focused on learning about activities that would help to illustrate the fundamentals, and hands-on investigations that would allow students to make their own observations. By comparison, the middle and high school teachers were interested in process and more in-depth investigations, as well as making connections to other concepts (both science and non-science).
- We saw no clear evidence that teachers have real plans for integration of the topics of solar energy and solar science. Only one participant (#10) had specific ideas about how to address both topics as a way to enhance student understanding. Judging from other responses, it appears that participants may have different interpretations of the term "integrating". Some took the word "integrate" to mean "include" in their teaching schedule (e.g. #5). It's possible that it's too early to ask this question of the teachers and that we might expect responses to this question to change or deepen after teachers have had a chance to teach a few lessons and/or attend future workshops. For example, one teacher simply stated that she did not understand the question (e.g. #4). One might also consider modifying the question in order to yield more specific feedback.

• Teachers seem confident and optimistic about their ability to bring the workshop activities back to their classrooms. However, they also anticipate facing some real challenges, the biggest one of which is the lack of time—time management, time to do the necessary preparations, time to do the lessons, time to fit the activities into their current curriculum.

Our follow-up survey will aim to reassess at a later date what teachers are thinking, what activities they have used in the classroom, how the workshops have helped them, how they managed to deal with challenges, and what further assistance they might need. We would also like to discuss possible questions for the follow-up survey with Ruth Paglierani and Karen Meyer of SSL.

Below you will find an overall summary of responses for each of the open-ended questions on the workshop questionnaire followed by notable quotes to illustrate what teachers were thinking. At the end, you will also find highlights of our observations of the two-day workshop.

* * *

Question #11: Did you come away from this two-day workshop with a new idea or new strategy that you want to include in your classroom practice? If so, can you describe your current thinking about this idea or strategy?

Overall:
• Hands-on activities made a big impact on participants. They appreciated the activities and plan to use them in their classrooms.
• Teachers have a clearer understanding of the topics.
• Participants have a greater understanding of solar energy, the earth's magnetosphere, electromagnetic spectrum, energy transformation, electrical circuits, and the reasons for seasons.

Notable quotes:
"Using an activity including a model in pre/post activity assessments. I think this is a good way to assess prior knowledge and learning, especially with English learners." [Elementary Teacher]

"Yes! I will definitely use the energy transformation labs with my 6th-7th students and the solar energy with high school and middle. Will also have these students teach to younger grades on campus."
[Middle/High Teacher]

"*Modeling sun-earth-magnetosphere relationships with lights, balls, wires to show relationships in 3D space. Using compasses to map magnetic fields on paper useful to visualize the invisible."*

[Middle/High Teacher]

Question #12: Did you notice points at which you could integrate solar science and solar energy that might help your students understand the topics? If so, can you describe your current thinking?

Overall:
- Participants have varied responses to this question.
- Participants seem eager to introduce concepts and activities from the workshop to their students.

Notable quotes:

"The Earth does not exist on its own—it is clearly tied to the sun in all ways. To understand sustainable practices and climate change, we need to teach solar science and energy." [Elementary Teacher]

"Yes. Energy audits would be good way for students to collect data, graph and do calculations as to energy output compared to other forms of energy transformations from monitoring PV cell, for example."
[Middle/High Teacher]

"Our topics (kits) of plants & insects, forces & motion—I also do my own lessons on astronomy/basic solar science, so it fits in well."
[Elementary Teacher]

"Understanding angle of light has to do with solar energy collection (via photovoltaic modules). Also it helps explain different rates of growth with plants." [Middle/High Teacher]

Question #13: Which resources did you find most useful and plan to use in your classroom instruction?

Participants found many of the resources useful and plan to use them in their classrooms. Different people mentioned different resources. Below is a list of the resources mentioned.

Classroom activities
Curriculum guides & materials
Lesson plans
Powerpoint slides
NEED energy packet & activities
Videos
Handouts
"Living with a Star"
Workshop presentations

Solar kits
PV's, PV module/array kit
Styrofoam balls to model sun/earth
Websites
Animation
Graphing daylight hours
GEMS guide
Pizza sun
Flash drive
Bar magnet
Sun lamp and globes
Circuits

Question #14: What challenges do you anticipate your students might have in learning about solar science and solar energy?

- Time constraints! Not enough time!
- Misunderstandings, misconceptions, preconceived notions.
- Little to no background knowledge
- Lack of materials

Notable quotes:

"They have very little science background and I would need to start at the beginning with 'What is the sun?' and 'What is a magnet?'"
[Elementary Teacher]

"There is a lot of information and to understand the more difficult topics, you have to really understand the basics. Just assuring that students are keeping up would be important." [Elementary/Middle Teacher]

"They have little to no understanding of motion or energy or how electricity works. Comparing solar energy and its improvements will undoubtedly be hampered by a lack of understanding of power generation."
[Middle Teacher]

"Visualizing these forces/qualities of sun (temp/size/distance) relative to how they perceive them here on earth. Understanding the roots of all the energy transformations that create electricity. Earth energy budget."
[Middle/High Teacher]

"They have a real lack of real-world experience as urban/indoor students. I think the activities will help make it all make sense. I will have to check to see which kids know what and use them to help." [High Teacher]

Question #15: What challenges do you anticipate facing as you try to teach solar science and solar energy to your students?

Overall:
- TIME!
- Time constraints
- Time management, classroom management
- Time for prep
- Time to do the lessons
- Time to fit it into a pre-set curriculum

Notable quotes:
"Same as always—finding enough time to do as much as I want.'" [Middle Teacher]

"I teach several grades and deciding what to use where (which grade) will be a challenge, and to what depth." [Elementary/Middle Teacher]

"Finding time to fit it into my scheduled week. Incorporating it into a pre-set curriculum developed by lead teachers." [Elementary Teacher]

"Making time in my high school bio curriculum. Teaching how magnetic and electrical fields produce each other." [Middle/High Teacher]

Question #16: Please give us your ideas/suggestions for improving this workshop.

Overall:
- Well-planned and well-executed workshops
- Inspired!
- Great presenters
- Love the presentations
- Love the background info
- More hands-on, less lecture

Notable quotes:
"Give us material to teach or review with small groups. "Teachers teaching teachers." Have us work as a group to create models of solar concepts and display them around the room. Suggest learning games that reinforce the material with students." [Elementary Teacher]

"Outdoor activity (if sun cooperates). Relate to life sciences--plant reactions/photosynthesis. Compare helioscience reactions/system to life sciences cycles." [Middle/High Teacher]

"This was the best teacher workshop I have ever attended. I loved the balance of high-level background science ed./info for teachers and experience with student labs. So much was presented but it did not feel rushed. Excellent planning and time management. Very calm and knowledgeable and entertaining presenters. Can't think of any suggestions." [Middle/High Teacher]

Highlights from Valeria's observation of the workshop:

• Energy: There was overall interest in understanding how energy related to alternative energy sources, non-renewable energy
• Magnetism: There was interest in better understanding magnetism. They held several misconceptions, particularly related to polarity.
• Electromagnetic Spectrum: Overall teachers seemed familiar with the light spectrum, and seemed interested in learning about and exploring the spectrum at a deeper level
• Different Forms of Energy: Teachers' level of knowledge was low on this topic, and they seemed to learn much on this topic. They really tried to understand WHY changes occurred.
• Seasons: Teachers seemed hesitant for almost all of the questions. They held several misconceptions. Visual representations were helpful.
• Emerging Solar Technologies: Teachers seem excited by this topic, especially PV cells.
• ELEMENTARY: Elementary teachers seem more focused on learning about activities that would help to illustrate the fundamentals, and hands-on investigations that would allow students to make their own observations.
• SECONDARY: Middle & High School teachers were interested in process and more in-depth investigations, as well as making connections to other concepts (science and non-science).
• OVERALL: Teachers seemed very interested and engaged when learning about methods/experiments they could use with their students.
• OVERALL: Teachers want to have reliable resources where they can go to for information. (Uncertainty about the internet, news, documentaries.)

Energy From the Sun—Solar Science and Solar Energy
Berkeley, June 28-29, 2011

Summary of results
Energy from the Sun Workshop
Berkeley – June 28-29, 2011

Most of the teachers came to the workshop with some prior knowledge of the subject matter, but left feeling they had gained much information, greater clarity, and fresh ideas for hands-on activities to bring back to their classrooms. About a third of the teachers had taught the topics as part of their curriculum, but just as many had not; the rest fell in the middle. Most of the teachers clearly understood the information presented in the workshop, and almost all indicated they would present the materials to their students as either an integral part or a supplement to their basic curriculum. About half of the teachers said they would train their fellow teachers and felt confident enough to do so; almost all said they would talk to colleagues about this workshop experience. More than half of the teachers do not anticipate facing barriers that would prevent them from implementing the topics covered in the workshop or needing help to present the materials either to their colleagues or their students. All of the teachers would definitely recommend this workshop to fellow teachers, and nearly all would do it all over again.

Responses to Post-Workshop Questionnaire
The highest percentages for each question are highlighted in yellow.

Participants by grade level
About two-thirds of the participants indicated that they teach grades K-5. About one-third of the participants indicated that they teach grades 6-12.

Grade Level	# of Respondents	% of All 24 Respondents
Elementary	17	71
Middle School	6	25
High School	4	17
TOTAL	27*	>100*

**Some participants chose more than one answer, so the total number of respondents (65) is greater than the number of respondents (24), and the total percent equals more than 100%.*

1) What is (are) the grade(s) of students that you teach? (Check all that apply)

Grade Taught	# of Responses	% of All 24 Respondents
K	3	12.5
1st	4	16.7
2nd	7	29.2
3rd	7	29.2
4th	10	41.7
5th	13	54.2
6th	5	20.8
7th	3	12.5
8th	4	16.7
9th	3	12.5
10th	3	12.5
11th	2	8.3
12th	1	4.2
Other	0	0
TOTAL	65*	>100*

**Some participants chose more than one answer, so the total number of responses (65) is greater than the number of respondents (24), and the total percent equals more than 100%.*

2) What is (are) the subject matter(s) that you teach? (Check all that apply)

Subject	# of Responses	% of All 24 Respondents
Art/Music	10	41.7
Drama	8	33.3
English/Lang Arts	15	62.5
Engineering	1	4.2
Foreign Lang	2	8.3
Guidance	2	8.3
Health	6	25
Media/Library	1	4.2
Mathematics	15	62.5
Physical Educ	7	29.2
Science	22	91.7
Social Studies	14	58.3
Technology	12	50

Other-specify	1 (Green Energy)	4.2
	1 (Special Ed)	4.2
TOTALS	117*	>100*

**Many participants chose more than one answer, so the total number of responses (117) is greater than the number of respondents (24), and the total percent equals more than 100%.*

3) You and your institution (Check all that apply)

Institution Type	Number of Respondents	Percent of All Respondents
Urban	11	45.8
Public	17	70.8
Private	1	4.2
Rural	3	12.5
Parochial	1	4.2
Charter	3	12.5
Suburban	2	8.3
Other	1	4.2

4) Use the chart below to describe the composition of your class making sure that your percentages sum to 100%.

African American (Female)	Number of Respondents	Percent of All Respondents
0	2	8.3
10% and under	13	54.2
10-25%	3	12.5
25-50%	1	4.2
50-75%		
75-100%	1	4.2
TOTAL	20	83.3
Missing	4	16.7

African American (Male)	Number of Respondents	Percent of All Respondents
0	2	8.3
10% and under	10	41.7

10-25%	3	12.5
25-50%	2	8.3
50-75%		
75-100%		
TOTAL	17	70.8
Missing	7	29.2

Asian (Female)	**Number of Respondents**	**Percent of All Respondents**
0	2	8.3
10% and under	14	58.3
10-25%	4	16.7
25-50%		
50-75%		
75-100%		
TOTAL	20	83.3
Missing	4	16.7

Asian (Male)	**Number of Respondents**	**Percent of All Respondents**
0	2	8.3
10% and under	13	54.2
10-25%	3	12.5
25-50%		
50-75%		
75-100%		
TOTAL	18	75
Missing	6	25

Hispanic/Latino (Female)	**Number of Respondents**	**Percent of All Respondents**
0		
10% and under	11	45.8
10-25%	7	29.2
25-50%	2	8.3
50-75%		
75-100%		
TOTAL	20	83.3
Missing	4	16.7

Hispanic/Latino (Male)	**Number of Respondents**	**Percent of All Respondents**
0		
10% and under	8	33.3

10-25%	8	33.3
25-50%	2	8.3
50-75%		
75-100%		
TOTAL	18	75
Missing	6	25

White (Female)	Number of Respondents	Percent of All Respondents
0		
10% and under	7	29.2
10-25%	6	25
25-50%	4	16.7
50-75%		
75-100%	2	8.3
TOTAL	19	79.2
Missing	5	20.8

White (Male)	Number of Respondents	Percent of All Respondents
0		
10% and under	6	25
10-25%	6	25
25-50%	4	16.7
50-75%		
75-100%	1	4.2
TOTAL	17	70.8
Missing	7	29.2

Other (Female)	Number of Respondents	Percent of All Respondents
0		
10% and under	9	37.5
10-25%	1	4.2
25-50%		
50-75%		
75-100%		
TOTAL	10	41.7
Missing	14	58.3

Other (Male)	Number of Respondents	Percent of All Respondents
0		
10% and under	8	33.3

10-25%	1	4.2
25-50%		
50-75%		
75-100%		
TOTAL	9	37.5
Missing	15	62.5

5) How many years have you been teaching—including this year?

Years Taught	Number of Respondents	Percent of All Respondents
<5 yrs	2	8.4
5-10 years	9	37.4
11-20	7	29.3
20+ years	4	16.7
TOTAL	22	91.7
Missing	2	8.3

6) Is your school a Title I school?

Title I	Number of Respondents	Percent of All Respondents
Yes	12	50
No	10	41.7
TOTAL	22	91.7
Missing	2	8.3

7) How many students do you teach in a typical year?

# Students Taught	Number of Respondents	Percent of All Respondents
1-20	2	8.3
21-30	7	29.2
31-60	6	25.1
61-100	2	8.3
101-200	4	16.8
201-300	2	8.3
Total Responses	23	95.8
Missing	1	4.2

8) With how many teachers do you anticipate sharing these materials/ideas?

# Teachers With Whom You Will Share Materials/Ideas	Number of Respondents	Percent of All Respondents
Up to 3	10	50.7
3-6	9	37.5
7-14	0	0
15-20	3	12.5
Total Responses	22	91.7
Missing	2	8.3

9) Please rate today's workshop in the table below by checking the extent to which you 'agree' or 'disagree' with each statement.

a) Prior to today, I had quite a bit of knowledge about the topics presented.

	Number of Responses	Percent of Respondents
Strongly Disagree	1	4.2
Disagree	7	29.2
In the Middle	10	41.7
Agree	4	16.7
Strongly Agree	1	4.2
TOTAL	23	95.8
Missing	1	4.2

b) Prior to today, I had used the topics presented as part of my curriculum or as a supplement to my basic curriculum.

	Number of Responses	Percent of Respondents
Strongly Disagree	2	8.3
Disagree	6	25
In the Middle	6	25
Agree	8	33.3
Strongly Agree	1	4.2
TOTAL	23	95.8
Missing	1	4.2

c) I clearly understand the information/topics presented in this workshop.

	Number of	Percent of

	Responses	Respondents
Strongly Disagree		
Disagree		
In the Middle	4	16.7
Agree	14	58.3
Strongly Agree	5	20.8
TOTAL	23	95.8
Missing	1	4.2

d) I will definitely present some of today's topics/materials to my students.

	Number of Responses	Percent of Respondents
Strongly Disagree		
Disagree		
In the Middle		
Agree	7	29.2
Strongly Agree	16	66.7
TOTAL	23	95.8
Missing	1	4.2

e) I feel that I know enough about the topics to confidently present them to my students.

	Number of Responses	Percent of Respondents
Strongly Disagree		
Disagree		
In the Middle	3	12.5
Agree	11	45.8
Strongly Agree	9	37.5
TOTAL	23	95.8
Missing	1	4.2

f) I plan to use the topics/materials as an integral part of my basic curriculum.

	Number of Responses	Percent of Respondents
Strongly Disagree		
Disagree	3	12.5
In the Middle	4	16.7
Agree	8	33.3
Strongly Agree	8	33.3
TOTAL	23	95.8
Missing	1	4.2

g) I plan to use the topics/materials as a supplement or resource to my basic curriculum.

	Number of Responses	Percent of Respondents
Strongly Disagree		
Disagree		
In the Middle		
Agree	12	50
Strongly Agree	11	45.8
TOTAL	23	95.8
Missing	1	4.2

h) I will use the materials in teaching non-science topics (for example, literacy or technology.)

	Number of Responses	Percent of Respondents
Strongly Disagree	2	8.3
Disagree	3	12.5
In the Middle	5	20.8
Agree	6	25
Strongly Agree	7	29.2
TOTAL	23	95.8
Missing	1	4.2

i) I will use the topics to train other teachers.

	Number of Responses	Percent of Respondents
Strongly Disagree		
Disagree	1	4.2
In the Middle	10	41.7
Agree	9	37.5
Strongly Agree	3	12.5
TOTAL	23	95.8
Missing	1	4.2

j) I know enough about the topics to confidently present them to my colleagues in a workshop-type setting.

	Number of Responses	Percent of Respondents
Strongly Disagree		
Disagree	4	16.7
In the Middle	4	16.7

Agree	11	45.8
Strongly Agree	4	16.7
TOTAL	23	95.8
Missing	1	4.2

k) I am certain that I will talk with colleagues about this workshop experience.

	Number of Responses	Percent of Respondents
Strongly Disagree		
Disagree		
In the Middle	1	4.2
Agree	11	45.8
Strongly Agree	11	45.8
TOTAL	23	95.8
Missing	1	4.2

l) I anticipate that there will be quite a few barriers that will make it difficult for me to implement these topics/materials.

	Number of Responses	Percent of Respondents
Strongly Disagree	5	20.8
Disagree	9	37.5
In the Middle	4	16.7
Agree	4	16.7
Strongly Agree	1	4.2
TOTAL	23	95.8
Missing	1	4.2

m) I think that I will need assistance while attempting to present these topics/materials to my students/colleagues.

	Number of Responses	Percent of Respondents
Strongly Disagree	3	12.5
Disagree	11	45.8
In the Middle	4	16.7
Agree	5	20.8
Strongly Agree		
TOTAL	23	95.8
Missing	1	4.2

n) I would definitely recommend this workshop to fellow teachers.

	Number of Responses	Percent of Respondents
Strongly Disagree		
Disagree		
In the Middle		
Agree	3	12.5
Strongly Agree	20	83.3
TOTAL	23	95.8
Missing	1	4.2

o) Knowing what I now know about this workshop, I would do it all over again.

	Number of Responses	Percent of Respondents
Strongly Disagree		
Disagree		
In the Middle	1	4.2
Agree	5	20.8
Strongly Agree	17	70.8
TOTAL	23	95.8
Missing	1	4.2

Responses to open-ended questions (#11-16):
The number before each response represents a participant. The same number in each of the following questions #11-16 represents the same participant.

11. Did you come away from this two-day workshop with a new idea or new strategy that you want to include in your classroom practice? If so, can you describe your current thinking about this idea or strategy?
1) I now have a stronger knowledge base regarding magnetism, solar energy, transformations of energy, the sun, the earth's magnetism. [Elementary]
2) Using an activity including a model in pre/post activity assessments. I think this is a good way to assess prior knowledge and learning, especially with English learners. [Elementary]
3) Yes. A list of hands-on ideas. Most of the "classroom" activities we did in the workshop. [Elementary]
4) Yes. I haven't done stations(?) at junior high level before. I be always done lacteraly(?) for whole class. [Middle]
5) Definitely will use activities for introducing magnetism, electromagnetic spectrum/light, reasons for seasons. [High]
6) BLANK [Elementary]
7) Yes--solar energy and how everything comes from the sun. [Elementary]
8) I want to include the idea of collecting data on the sun throughout the school year. [Elementary]
9) Yes, I can put more teaching for understanding than before. More hands on to help me become more successful. [Elementary]
10) I have seen teaching my students about energy sources but I did not have the background before to really teach the basics of energy on Earth. [Elementary]
11) Yes--sun's importance--relation to solar panel system at my school [Elementary]
12) The "connection" between magnetism, electricity and the sun/earth is so important and will help reinforce learning on all these "topics" for students. [Elementary]
13) Reasons for seasons and interactive way to present; shape of earth's orbit; how sun strikes earth (using flashlights & grid); bring in cell phone science [Middle]
14) Integrate the "energy" topics related to the sun during our unit on Energy and Matter in beginning of the year and cover the Reason for Seasons, Earth, Moon topics in our last unit "Sun, Moon, Stars". [Elementary]
15) The hands on activities were all wonderful. I would want to make sure that the solar science and solar energy concepts were all accompanied by a visual or hands on activity. [Elementary/Middle]
16) Re-organize presentation of Reasons for Seasons, use some of the ideas presented. Clarify discussions of energy transfers to reflect organization presented. [Elementary]
17) Measuring energy used by the 3 different light bulbs. Solar cooking. [Elementary]
18) Much clearer on incorporating solar energy into 5th grade weather and currents and solar system. 4th grade--much clearer on whole view of electromagnetism. [Elementary]

19) Modeling seasons; solar cooking; graphing hours of light in various regions; solar energy, measuring (panels), analysis of light spectrum. [Elementary]
20) Yes! I will definitely use the energy transformation labs with my 6-7th students and the solar energy with high school and middle. Will also have these students teach to younger grades on campus. [Middle/High]
21) Modeling sun-earth-magnetosphere relationships with lights, balls, wires to show relationships in 3D space. Using compasses to map magnetic fields on paper useful to visualize the invisible. [Middle/High]
22) I want to incorporate more of the energy ideas/concepts into what I'm teaching in science. It will be interesting and a challenge bringing it down to a 2nd grade level. [Elementary]
23) Connecting magnetism, electromagnetism to it's relationship to the Sun and how it's connected to energy. [Elementary]
24) The bar magnet and tracing the field and presenting the electromagnetic spectrum--Then today, the circuits (parallel & series)! Also the solar system/earth (ball on a stick) reasons for the seasons and angle of light. This is really useful! [High]

12. Did you notice points at which you could integrate solar science and solar energy that might help your students understand the topics? If so, can you describe your current thinking?

1) I would like to create a hands-on solar energy education room at my new school. [Elementary]
2) BLANK [Elementary]
3) Yes--where energy comes from, conservation, what is energy. [Middle]
4) Don't understand question. [Middle]
5) I'll integrate the activities above into units on motors and generator, solar energy (solar cookers) and photovoltaic. [High]
6) BLANK [Elementary]
7) Yes--I want to bring solar energy info to all students and teach them how important it is. [Elementary]
8) Yes, the eye on the sky does a great job of that & NEED too, cooking with the sun, making a solar clock. [Elementary]
9) Yes [Elementary]
10) The Earth does not exist on its own--it is clearly tied to the sun in all ways. To understand sustainable practices and climate change, we need to teach solar science and energy. [Elementary]
11) Yes--with the kit; integrate space science [Elementary]
12) Solar energy such as solar cooking or DV projects can bring hands on project based learning to students to create authentic learning with a purpose. [Elementary]
13) graphing of electromagnetic spectrum. [Middle]
14) BLANK [Elementary]
15) BLANK [Elementary/Middle]
16) Utilize examples of solar heating and do solar cooking. Convey the enriched context from this workshop. [Elementary]

17) Yes, sun is not an "average" star.; Magnetism and polarity; electromagnetic spectrum. Most points are worthy of presentation. [Elementary]
18) Energy flow and convertion(sic). More examples of direct solar energy (ovens & PVC). [Elementary]
19) BLANK [Elementary]
20) Yes--lots of good analogies. [Middle/High]
21) Yes. Energy audits would be good way for students to collect data, graph and do calculations as to energy output compared to other forms of energy transformations from monitoring PV cell, for example. [Middle/High]
22) Our topics (kits) of plants & insects, forces & motion--I also do my own lessons on astronomy/basic solar science so it fits in well. [Elementary]
23) The relationship between harnessing earth's energy when we rotate around the sun and the amount of sunlight changes and how that affects the power of a solar module. [Elementary]
24) Understanding angle of light has to do with solar energy collection (via photovoltaic modules). Also it helps explain different rates of growth with plants. [High]

13. Which resources did you find most useful and plan to use in your classroom instruction?

1) The hands-on activities and inquiry-based instruction. Receiving instruction from experts in the field was very broadening as an educator. [Elementary]
2) (1) The archeo astronomy book. (2) Solar pizza. (3) Eye on the sky curriculum. [Elementary]
3) Classroom activities. Powerpoint slides. [Elementary]
4) NEED energy packet. [Middle]
5) Magnets, demos about seasons, u.v. beads (into my biology course, evolution of skin color) [High]
6) BLANK [Elementary]
7) Curriculum guides [Elementary]
8) All. [Elementary]
9) Videos/handouts [Elementary]
10) "Living with a Star"; videos on travel drive; need (NEED?) project materials--pv cell kit. I need to review everything first so I can plan to really integrate all I have learned into my units. [Elementary]
11) Hands on and background data around topics [Elementary]
12) The solar resource kit is a fantastic asset for bringing this to students most immediately. The other examples that were shown and demonstrated are the next step as I gather materials and create these resources. [Elementary]
13) Living with a star. All of Bryan Mendez's lectures--a gifted lecturer on his topic, which should enable me to integrate information accurately and with a confidence. [Middle]
14) NEED kits; powerpoint presentations; curricular materials. [Elementary]
15) Hands on activities, pictures, lesson plans. [Elementary/Middle]
16) PV's, solar kits; websites, animation. [Elementary]

17) Graphing daylight hours; videos on sun taken with different light spectrums. [Elementary]
18) Needs activities and kits very useful. More so than Gems guide on living with a star. Really liked activities in other GEMS guide on magnetism and electricity. [Elementary]
19) Pizza sun. [Elementary]
20) Living with a star and energy transformations and seasons (polystyrene balls) [Middle/High]
21) PV module/array kit. Light and styrofoam balls to model sun/earth in space. [Middle/High]
22) The flash drive will be a big help. I'm sure the NEED materials (once looked at) will be a benefit and great resource [Elementary]
23) Lessons demonstrating earth's seasons. Book on (sic). [Elementary]
24) See answer to #11--bar magnet, sun lamp and globes, circuits. [High]

14. What challenges do you anticipate your students might have in learning about solar science and solar energy?

1) Time constraints in the day. I would like more materials so that students individually get to handle materials. [Elementary]
2) 1) Letting go of prior misconceptions. 2) Retaining vocabulary. [Elementary]
3) Not enough time! [Elementary]
4) None. [Middle]
5) Misconception about science, basic scientific ignorance [High]
6) BLANK [Elementary]
7) Students might have issues with concepts. [Elementary]
8) BLANK [Elementary]
9) Some confusing thoughts when comparing and questioning today's lifestyle. [Elementary]
10) Time is always a problem! [Elementary]
11) Setting bar too high to start; overcoming misunderstandings. [Elementary]
12) Student challenge is below level reading. [Elementary]
13) They have little to no understanding of motion or energy or how electricity works. Comparing solar energy and its improvements will undoubtedly be hampered by a lack of understanding of power generation. [Middle]
14) Time constraints mostly. [Elementary]
15) There is a lot of information and to understand the more difficult topics you have to really understand the basics. Just assuring that students are keeping up would be important. [Elementary/Middle]
16) Time to digest material and opportunities to manipulate materials. [Elementary]
17) Coming in with zero background, zero vocabulary. I think they will be excited after that. [Elementary]
18) Spend on it. We do the FOSS kits. They take a lot of time. [Elementary]
19) Lack of all necessary materials i.e. viable "sun source" in room, panels, polystyrene balls--etc. [Elementary]
20) Scale misconceptions, seasons understanding the nature of EMR. [Middle/High]

21) Visualizing these forces/qualities of sun (temp/size/distance) relative to how they perceive them here on earth. Understanding the roots of all the energy transformations that create electricity. Earth energy budget. [Middle/High]
22) Preconceived notions and ideas--they are positive that they know things. [Elementary]
23) They have very little science background and I would need to start at the beginning with "What is the sun?" and "What is a magnet?" [Elementary]
24) They have a real lack of real world experience as urban/indoor students. I think the activities will help--make it all make sense. I will have to check to see which kids know what and use them to help. [High]

15. What challenges do you anticipate facing as you try to teach solar science and solar energy to your students?
1) Time constraints but I plan to work with fellow grade-level teachers to develop a rotation system to include solar education. [Elementary]
2) Classroom management, set-up time for certain activities. [Elementary]
3) Not enough time! [Elementary]
4) Same as always--finding enough time to do as much as I want. [Middle]
5) BLANK [High]
6) BLANK [Elementary]
7) How to integrate it with afterschool programs. [Elementary]
8) I'm technically challenged. We don't have up to date technology, but the images/movies I will need some help with. [Elementary]
9) Getting information out correctly. [Elementary]
10) Time--I am adding this to the 3 units I already teach. I will need to drop off some older activities. [Elementary]
11) Time & possibly materials--materials budget is tight this year--will look for grants. [Elementary]
12) Squeezing in time to adequately study/learn these topics in the standards based environment that separates these topics is a challenge. [Elementary]
13) Keeping to the standards--much of this is great info that they should/need to know how do I cover the background on our solar system that they might or might not have had to get to star study. [Middle]
14) Time constraints. [Elementary]
15) I teach several grades and deciding what to use where (which grade) will be a challenge and to what depth. [Elementary/Middle]
16) Time management. [Elementary]
17) Time for prep is always a factor. [Elementary]
18) Making it happen. The thinking it out and incorporating it. [Elementary]
19) Lack of time. Planning solar activities in alignment with important points in the year (i.e. equinox) [Elementary]
20) Making time in my high school bio curriculum. Teaching how magnetic and electrical fields produce each other. [Middle/High]
21) Earth energy budget. Describing the qualities of the sun (what it's made of, how its reactions work to create magnetic fields.) Some of the chemistry of materials that enable magnetism, PV cells. [Middle/High]

22) Finding time to do the lessons/activities with the materials needed; being sure that I remember what I've learned! [Elementary]
23) Finding time to fit it into my scheduled week. Incorporating it into a pre-set curriculum developed by lead teachers. [Elementary]
24) Getting the materials together--getting it all organized into the curriculum as well as… [High]

16. Please give us your ideas/suggestions for improving this workshop.
1) Thank you for a very well-planned and executed workshop. I am now inspired to continue exploring and sharing my newly gained information! [Elementary]
2) Give us material to teach or review with small groups. "Teachers teaching teachers." Have us work as a group to create models of solar concepts and display them around the room. Suggest learning games that reinforce the material with students. [Elementary]
3) It was great! Thank you for all the work that went into it. [Elementary]
4) Great as is. [Middle]
5) This was a good workshop. Presenters were great. I'll recommend this to my colleagues. [High]
6) BLANK [Elementary]
7) I love all the background info. Keep up everything you do. [Elementary]
8) Love all of the presentations and ideas presented. [Elementary]
9) BLANK [Elementary]
10) The workshop was excellent and the presenters just wonderful. Thank you for the food and treats! I look forward to Oct. 15th. [Elementary]
11) More hands-on activities--less lecture. [Elementary]
12) This was fantastic. The variety of knowledge and experiences of the trainers was fabulous. [Elementary]
13) BLANK [Middle]
14) Everyone did an amazing job imparting/reviewing concepts! And ways to teach them in the classroom. Thank you to all! [Elementary]
15) Loved the workshop, super informing, great presenters, friendly and enthusiastic. [Elementary/Middle]
16) More sun. [Elementary]
17) Well done and thanks. [Elementary]
18) BLANK [Elementary]
19) Have it some place else. Provide resources or alternative to actually do the activities at the training. [Elementary]
20) This was the best teacher workshop I have ever attended. I loved the balance of high-level background science ed./info for teachers and experience with student labs. So much was presented but it did not feel rushed. Excellent planning and time management. Very calm and knowledgeable and entertaining presenters. Can't think of any suggestions. [Middle/High]
21) Outdoor activity (if sun cooperates). Relate to life sciences--plant reactions/photosynthesis. Compare helioscience reactions/system to life sciences cycles. [Middle/High]

22) Thanks! [Elementary]
23) BLANK [Elementary]
24) More time? [High]

Evaluation Report from the Participant Survey
Sacramento Workshop
August 2011

A Report Submitted to Space Sciences Lab

The Research Group
Lawrence Hall of Science
University of California, Berkeley

September 2011

Introduction: Institute Description and Goals

In August 2011, the Energy From the Sun in Space and on Earth (ESSE) program presented a two-day professional development workshop for educators in Sacramento. The goals of this workshop were to provide participants with expanded content knowledge of social science and solar energy, plus present a series of hands-on activities that participants could share with students and colleagues. Finally, participants received a kit of materials that would help them implement the activities in the classroom.

In order to evaluation these sessions, researchers from the Lawrence Hall of Science (the Hall), in collaboration with the ESSE program team, developed a feedback survey for participants. In addition, a researcher from the Lawrence Hall of Science attended all professional development sessions, which provided additional insight into the process and the outcomes.

This report presents information from the feedback survey and observations.

Evaluation of Sessions

Two different surveys were administered to participants: one developed by researchers from the Hall and another provided by the host organization, Sacramento Municipal Utility District (SMUD). In order to reduce the burden on participants, duplicate questions were removed from the Hall's survey.

For the Hall survey, a total of 25 surveys were completed and returned to the evaluator. Based upon the 25 participants in attendance, this represents a response rate of 100 percent. For the SMUD survey, 24 surveys were returned, for a 96 percent response rate. The SMUD survey did not ask for participant characteristics, so comparisons between groups (e.g., elementary compared with non-elementary teachers) could not be made.

Participant Characteristics

Participants ranged from Pre-K teachers to teacher trainers to college instructors. This range was both conducive to exploring different ways to present the same material but also offered challenges to the presenters. However, as will be discovered below, the range of activities offered covered the needs of all the participants.

<u>Grade levels taught</u>

Participants were almost equally divided between those that taught elementary (K-5 or K-6) and those that taught middle or high school (Gr 6-12 or Gr 7-12) or "other" programs. Other programs included Pre-K (3 participants); teacher trainers and after-school programs (2 participants); special education and college level programs (1 each). Table 1 presents these data.

TABLE 1: DISTRIBUTION OF PARTICIPANTS BY GRADE LEVELS THEY TEACH

Level	Number	Percent
Elementary	12	50%
Middle or High	5	21%
Other programs	9	38%

Note: Some participants belong in multiple categories, so the numbers do not add up to 100 percent.

Subjects taught

Participants taught a variety of subject matters, which is not surprising, given that most teach in a multiple-subject setting (e.g., elementary, Pre-K, afterschool program, or special education). All five middle or high school teachers teach science.

Institutions

Although participants were asked to describe both the urbanicity of their school and whether their school was public, private, parochial, or charter, many marked only one response category. The modal schools, where indicated, were public, suburban. Most (60 percent), where applicable, are not Title I schools.

Teaching experience and planned sharing

Participants had an average of 15 years of teaching experience; this ranges from 1 to 40 years. They teach an average of 65 students, ranging from 17 to 210 per year. They anticipate sharing with an average of nine colleagues, ranging from 2 colleagues to 45 colleagues.

Overall

- All participants found the workshop valuable and felt that appropriate and interesting content was presented. This finding is based on the survey results that showed that all respondents agreed with statements about the value of the workshop and their learning during those days.
- All participants would recommend the workshop to their colleagues.

Content Learning

- Most participants did not feel that they had extensive content knowledge prior to the workshop.
- Participants learned a range of content from the sessions – it was clear that different people filled different gaps in their knowledge.
- Electricity and circuits was one of the more common areas where respondents felt that they gained new content knowledge.
- While several participants worry that the content might be too challenging for their students – or that they might not be able to convey the information clearly to their students – this was generally only true of those teaching very young (i.e., Pre-Kindergarten) children or Special Education students.
- All but one felt that their content knowledge was expanded during the course of the session (and that one was an outlier in many areas; it should be noted that s/he found the workshop useful but has an advanced degree in the field).

Integration of Solar Science and Solar Energy

- The integration of solar energy and solar science was not always clear. Few participants were able to describe how they would integrate the two (although this may be an artifact of the survey question).
- Observing the sessions, it seemed that more clarity about the integration of the two areas would be helpful. When this did occur, it clarified the concepts. For example, one presenter segued between a presentation on shadows and his own about designing solar houses by specifically drawing the connection between the two.

Strategies and Techniques

- Participants most appreciated learning the hands-on activities. Almost every participant mentioned that having access to the materials for the hands-on activities was a major benefit.
- It was also helpful that participants were exposed to a range of activities. Since participants teach everything from Pre-K to college, they appreciated the options available.
- No one activity received more comments that the others. Participants mentioned: circuits, solar fountains, solar cooking, among others.

What would participants like more of

- In general, participants would not change much about content of the sessions or the activities presented.
- Two participants suggested making the workshop longer in order to cover the same content.

Logistics and Pacing

- The pacing of the sessions was good, considering the amount of content that needed to be covered. Only a couple of respondents felt commented that the pacing was too fast.
- Unlike what we find in many cases with professional development feedback, the food and room set up received little comment (either good or bad). The comments included:
    - Appreciation of the slightly later start, especially in summer
    - Ice would be nice for the drinks with lunch

Planned implementation

- All participants felt confident that they would use at least some of the activities or content with their students.
- Participants were more likely to plan to implement as a supplement to the basic curriculum than as integrated into main curriculum.

Challenges anticipated

- Overall, few participants anticipated challenges or barriers to implementing the materials.

- The major challenge teachers anticipated was finding the time to cover this content, along with all of the other content they must cover
- The only difference between elementary and non-elementary teachers was in the anticipation of barriers. Elementary teachers were slightly *less* likely to anticipate barriers than were non-elementary teachers. This is contrary to what was expected. It should be noted, however, that half of the non-elementary teachers are *not* high school or middle school teachers but rather teacher trainers or other educators. These are the ones that are more likely to anticipate barriers.
- In addition, several teachers worried that they might not have enough of the materials for their class. They stressed that they lacked funding to purchase supplemental materials (but, it should be noted, this did not mean that they didn't appreciate receiving the kits).

Table 2 presents the average rating for each of the individual items on both the LHS and the SMUD surveys. Full distribution of survey responses for most items is presented in the Appendix.

Conclusion

Based on data collected, both from surveys and through evaluations, it appears that the goals of the sessions were met. Participants, in most cases, did not enter the workshop with strong content knowledge or experience presenting these topics and materials; they emerged, again, in most cases, with increased confidence and a commitment to implement the topics. They appreciated the hands-on materials they received and plan to use a wide range of the activities with their students. Give the variety of educational levels and institutions represented, the program presenters did a very good job covering important topics and demonstrating a wide range of potential activities. The one area for improvement might be to figure how to present the integration of the solar science and solar energy topics more clearly and concisely. However, in summary, the sessions were a valuable use of participant's time, and they would strongly recommend it to colleagues.

TABLE 2. AVERAGE ITEM RATING

(5=Agree strongly; 1=Disagree strongly)			
Item	N	Mean	Std. Deviation
You would recommend this workshop to a colleague.	25	4.84	0.37
This workshop was a valuable use of your time.	25	4.84	0.37
This workshop met your expectations.	25	4.76	0.44
Useful ideas, techniques, and skills were presented.	25	4.68	0.48
Information was relevant personally and/or professionally.	25	4.64	0.49
I will definitely present some of today's topics/materials to my students.	24	4.63	0.58
Your teaching knowledge for this topic was expanded.	24	4.60	0.57
Knowing what I now know about this workshop, I would do it all over again.	24	4.58	0.72
The workshop was easy to understand.	25	4.44	0.58
I am certain that I will talk with colleagues about this workshop experience.	24	4.38	0.82
Your individual questions were clearly answered.	25	4.24	0.66
I plan to use the topics/materials as a supplement or resource to my basic curriculum.	22	3.95	0.90
I feel that I know enough about the topics to confidently present them to my students.	24	3.88	0.80
I will use the topics to train other teachers.	24	3.75	0.68
I plan to use the topics/materials as an integral part of my curriculum.	23	3.74	0.75
I will use the materials in teaching non-science topics (e.g., literacy or technology).	23	3.65	0.71
I know enough about the topics to confidently present them to colleagues in a workshop-like setting.	23	3.39	0.84
Prior to today, I had quite a bit of content knowledge about the topics presented.	24	2.96	1.20
I think that I will need assistance while attempting to present these topics/materials to my students/colleagues.	24	2.83	0.96
Prior to today, I had used the topics presented as part of my curriculum or as a supplement to my basic curriculum.	23	2.83	1.27
I anticipate that there will be quite a few barriers that will make it difficult for me to implement these topics/materials.	23	2.74	1.05

Appendix A: Frequency Tables for Closed-Ended Items

Appendix A: Frequency Tables for Closed-Ended Items

Definitions of terms included in tables:

Frequency: The number of respondents who marked each particular response.

Percent: The percentage of total surveys for that cohort marked with each particular response.

Valid percent: The percentage of surveys that included a response to that item.

System Missing: The number of surveys without a valid response to each item.

Item 1: Please rate today's workshop in the table below by checking the extent to which you 'agree' or 'disagree' with each statement...

a. Prior to today, I had quite a bit of knowledge about the topics presented.

		Frequency	Percent	Valid Percent
Valid	Strongly agree	3	12.5	12.5
	Agree	4	16.7	16.7
	Neutral	9	37.5	37.5
	Disagree	5	20.8	20.8
	Strongly disagree	3	12.5	12.5
	Total	24	100.0	100.0

b. Prior to today, I had used the topics presented as part of my curriculum or as a supplement to my basic curriculum.

		Frequency	Percent	Valid Percent
Valid	Strongly agree	2	8.3	8.7
	Agree	6	25.0	26.1
	Neutral	5	20.8	21.7
	Disagree	6	25.0	26.1
	Strongly disagree	4	16.7	17.4
	Total	23	95.8	100.0
	System Missing	1	4.2	
Total		24	100.0	

c. I will definitely present some of today's topics/materials to my students.

		Frequency	Percent	Valid Percent
Valid	Strongly agree	16	66.7	66.7
	Agree	7	29.2	29.2
	Neutral	1	4.2	4.2
	Disagree	0	0.0	0.0
	Strongly disagree	0	0.0	0.0
	Total	24	100.0	100.0

d. I feel that I know enough about the topics to confidently present them to my students.

		Frequency	Percent	Valid Percent
Valid	Strongly agree	5	20.8	20.8
	Agree	12	50.0	50.0
	Neutral	6	25.0	25.0
	Disagree	1	4.2	4.2
	Strongly disagree	0	0.0	0.0
	Total	24	100.0	100.0

e. I plan to use the topics/materials as an integral part of my basic curriculum.

		Frequency	Percent	Valid Percent
Valid	Strongly agree	3	12.5	13.0
	Agree	12	50.0	52.2
	Neutral	7	29.2	30.4
	Disagree	1	4.2	4.3
	Strongly disagree	0	0.0	0.0
	Total	23	95.8	100.0
	System Missing	1	4.2	
Total		24	100.0	

f. I plan to use the topics/materials as a supplement or resource to my basic curriculum.

		Frequency	Percent	Valid Percent
Valid	Strongly agree	6	25.0	27.3
	Agree	11	45.8	50.0
	Neutral	3	12.5	13.6
	Disagree	2	8.3	9.1
	Strongly disagree	0	0.0	0.0
	Total	22	91.7	100.0
	System Missing	2	8.3	
Total		24	100.0	

g. I will use the materials in teaching non-science topics (for example, literacy or technology).

		Frequency	Percent	Valid Percent
Valid	Strongly agree	2	8.3	8.7
	Agree	12	50.0	52.2
	Neutral	8	33.3	34.8
	Disagree	1	4.2	4.3
	Strongly disagree	0	0.0	0.0
	Total	23	95.8	100.0
	System Missing	1	4.2	
Total		24	100.0	

h. I will use the topics to train other teachers.

		Frequency	Percent	Valid Percent
Valid	Strongly agree	3	12.5	12.5
	Agree	12	50.0	50.0
	Neutral	9	37.5	37.5
	Disagree	0	0.0	0.0
	Strongly disagree	0	0.0	0.0
	Total	24	100.0	100.0

i. I know enough about the topics to confidently present them to my colleagues in a workshop-type setting.

		Frequency	Percent	Valid Percent
Valid	Strongly agree	2	8.3	8.7
	Agree	8	33.3	34.8
	Neutral	10	41.7	43.5
	Disagree	3	12.5	13.0
	Strongly disagree	0	0.0	0.0
	Total	23	95.8	100.0
	System Missing	1	4.2	
Total		24	100.0	

j. I am certain that I will talk with colleagues about this workshop experience.

		Frequency	Percent	Valid Percent
Valid	Strongly agree	13	54.2	54.2
	Agree	8	33.3	33.3
	Neutral	2	8.3	8.3
	Disagree	1	4.2	4.2
	Strongly disagree	0	0.0	0.0
	Total	24	100.0	100.0

k. I anticipate that there will be quite a few barriers that will make it difficult for me to implement these topics/materials.

		Frequency	Percent	Valid Percent
Valid	Strongly agree	2	8.3	8.7
	Agree	1	4.2	4.3
	Neutral	12	50.0	52.2
	Disagree	5	20.8	21.7
	Strongly disagree	3	12.5	13.0
	Total	23	95.8	100.0
	System Missing	1	4.2	
Total		24	100.0	

l. I think that I will need assistance while attempting to present these topics/materials to my students/colleagues.

		Frequency	Percent	Valid Percent
Valid	Strongly agree	2	8.3	8.3
	Disagree	4	16.7	16.7
	Neutral	11	45.8	45.8
	Agree	6	25.0	25.0
	Strongly disagree	1	4.2	4.2
	Total	24	100.0	100.0

m. Knowing what I now know about this workshop, I would do it all over again.

		Frequency	Percent	Valid Percent
Valid	Strongly agree	16	66.7	66.7
	Agree	7	29.2	29.2
	Neutral	0	0.0	0.0
	Disagree	1	4.2	4.2
	Strongly disagree	0	0.0	0.0
	Total	24	100.0	100.0

Item 2. [From SMUD survey]: Please state whether you strongly agree, agree, disagree, or strongly disagree with the following statements.

a. The workshop was easy to understand.

		Frequency	Percent	Valid Percent
Valid	Agree Strongly	12	48.0	48.0
	Agree	12	48.0	48.0
	Neutral	1	4.0	4.0
	Disagree	0	0.0	0.0
	Disagree Strongly	0	0.0	0.0
	Total	25	100.0	100.0

b. Useful ideas, techniques, and skills were presented.

		Frequency	Percent	Valid Percent
Valid	Agree Strongly	17	68.0	68.0
	Agree	8	32.0	32.0
	Neutral	0	0.0	0.0
	Disagree	0	0.0	0.0
	Disagree Strongly	0	0.0	0.0
	Total	25	100.0	100.0

c. Your teaching knowledge for this topic was expanded.

		Frequency	Percent	Valid Percent
Valid	Agree Strongly	15	60.0	60.0
	Between AS and A	1	4.0	4.0
	Agree	7	28.0	28.0
	Neutral	1	4.0	4.0
	Disagree	0	0.0	0.0
	Disagree Strongly	0	0.0	0.0
	System Missing	1	4.2	
	Total	25	100.0	100.0

d. Your individual questions were clearly answered.

		Frequency	Percent	Valid Percent
Valid	Agree Strongly	9	36.0	36.0
	Agree	13	52.0	52.0
	Neutral	3	12.0	12.0
	Disagree	0	0.0	0.0
	Disagree Strongly	0	0.0	0.0
	Total	25	100.0	100.0

e. Information was relevant personally and/or professionally.

		Frequency	Percent	Valid Percent
Valid	Agree Strongly	16	64.0	64.0
	Agree	9	36.0	36.0
	Neutral	0	0.0	0.0
	Disagree	0	0.0	0.0
	Disagree Strongly	0	0.0	0.0
	Total	25	100.0	100.0

f. You would recommend this workshop to a colleague.

		Frequency	Percent	Valid Percent
Valid	Agree Strongly	21	84.0	84.0
	Agree	4	16.0	16.0
	Neutral	0	0.0	0.0
	Disagree	0	0.0	0.0
	Disagree Strongly	0	0.0	0.0
	Total	25	100.0	100.0

g. This workshop was a valuable use of your time.

		Frequency	Percent	Valid Percent
Valid	Agree Strongly	21	84.0	84.0
	Agree	4	16.0	16.0
	Neutral	0	0.0	0.0
	Disagree	0	0.0	0.0
	Disagree Strongly	0	0.0	0.0
	Total	25	100.0	100.0

h. This workshop met your expectations.

		Frequency	Percent	Valid Percent
Valid	Agree Strongly	19	76.0	76.0
	Agree	6	24.0	24.0
	Neutral	0	0.0	0.0
	Disagree	0	0.0	0.0
	Disagree Strongly	0	0.0	0.0

		Frequency	Percent	Valid Percent
Valid	Agree Strongly	19	76.0	76.0
	Agree	6	24.0	24.0
	Neutral	0	0.0	0.0
	Disagree	0	0.0	0.0
	Disagree Strongly	0	0.0	0.0
	Total	25	100.0	100.0

Item 3. Overall Value of Workshop

Overall, how valuable do you feel this workshop has been to your ability to teach the topics of solar science and solar energy?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very valuable	19	79.2	79.2	79.2
	Moderately valuable	1	4.2	4.2	83.3
	Valuable	3	12.5	12.5	95.8
	Not that valuable	1	4.2	4.2	100.0
	Total	24	100.0	100.0	

[Note: One participant included this comment on the survey: "I marked 'Not that valuable' because I have a PhD in Space Physics. More interested in K12 outreach."

Appendix B: Responses to Open-Ended Items

Appendix B: Responses to Open-Ended Items, Other Comments, and Marginalia

Below are transcriptions of all comments that respondents made to the survey. They have been split into categories and so often represent different ideas from the same respondent.

Item 1. Did you come away from this workshop with new idea of new strategy?

23 responses

WILL USE NEW CONTENT

- Definitely I intend to use the new info to help me teach about the magnetic poles and magnetism in connection with our solar system unit. I need to review 4t grade magnetism before the 5th grade science Star test. This will enable me to integrate the subject.
- I gained new strategies to expand how I teach these topics.
- I used the info I had more in science only classes and After School Program.

WILL INTEGRATE WITH OTHER CONTENT

- Need more time to marinate on everything but I know I will be using things. Discussion about social justice and distribution of resources.
- Yes, I am thinking about creating a unit that looks at sun use from a historic standpoint. For example, look at how earlier groups used the sun for a calendar (Native Americans). Then I would look at simple ways we use it today. Finally, I would have students imaginatively create/think about future uses.
- Yes. My favorite part of the two days was the break out session with real life hands on ideas which integrated curriculum areas.

PLAN TO USE ACTIVITIES

- Definitely using the solar panels and make a pump fountain. Possibly a volcano out of chicken wire and papier-mâché that sits over a bucket of water with a pipe and pump that pumps up the ""eruption
- Even young children can appreciate and comprehend concepts that may be difficult or complex if the teacher is able to present these concepts using hands-on activities. [Pre-K teacher]
- I liked many of the sessions -- my favorites were the solar panels, building design and the information on the sun.
- I've been exposed to many new ideas and new strategies that I will differently include in my program. I will introduce solar cooking, electricity to generate our music (boom box) and just so many other things I don't have space to include.
- Incorporate materials ... [illegible]

- The solar panels for circuit are so cool. I'm definitely planning on using those and also comparing to chemical batteries we use in the classroom. I'm also working on elementary school curriculum using playdoh for "wires" in circuits and using solar panels to supply the power for those.
- Yes -- doing hands on more.
- Yes, I got some new ideas about how to tweak some of the lessons ie., the balloon rocket graph and just some ways I can differentiate instruction.
- Yes, I will use the solar cooking. Also use the solar panels to show alternative power source for their favorite toys.
- Yes. I plan to introduce the idea of solar energy to my students by using solar panels for radio, possible mister on playground. I also plan to do solar cooking with my students.

NO SPECIFIC PROJECT

- I am thinking of including a solar project in my classroom with solar energy.
- I don't have any well-developed ideas, but I want to include a solar energy unit in my physics class.
- Loved the solar weather activity with news reports and data. Very cute.
- Most validation for how I teach -- that I'm on the right track.
- Yes
- Yes ... I run an after school program and will be able to use all the ideas and projects we learned in this workshop.
- Yes. This will be fabulous and cut through the standards in a better way.

NO STRATEGIES

- Because I teach college, I will not be to do [sic] many of the hands-on exercises (not enough time) but I hope to bring the ideas to my greater community.

Item 2. Did you notice points at which you could integrate solar science and solar energy…?

17 responses

THROUGH CONTENT

- Solar energy production from winter to summer and at different latitudes in dependent on Sun's position in day sky. I can use that in my intro to Astronomy class when I talk about seasons.
- Solar Science is already a major component to my teaching. Adding solar energy is going to add value and understanding.
- The science curriculum has a section on astronomy.

THROUGH PROJECTS OR ACTIVITIES

- Building a solar home.

- I did like the magnet and compass to show the earth's poles.
- Structure of the sun poster.
- There were several things I could use to integrate solar science and solar energy to help my students again it would depend on the age group I have and what we were doing at the time. Example: cooking, talking about the sun.
- Yes -- using solar panels and magnets activities.
- Yes with all the hands on materials we received and knowledge acquired, I feel the children will grasp the concepts.
- Yes, see above for circuits. [I'm also working on elementary school curriculum using playdoh for "wires" in circuits and using solar panels to supply the power for those.] Magnetism and charges can also incorporate solar science and energy scales showing energy in Joules of solar energy, H-bombs, lifting lemons ... good stuff!

INTEGRATES WITH OTHER CURRICULAR AREAS

- I would use math to discuss ratios, measurement, calculations, etc. as they relate to space.
- It fits in well with our Open Court series and Math.
- This fits into so many areas, especially social studies and science.
- Yes, we have a unit in reading on astronomy. I would focus on sun-related activities from the various resources.

NO SPECIFIC STRATEGIES OR IDEAS

- I need to synthesize the information and will provide more info on 12/3.
- I will [illegible] more feedback in the next few weeks.
- Yes
- Yes -- I need to figure it out first.

Item 3. What challenges do you anticipate your students might have in learning about solar science and solar energy?

17 responses

DIFFICULTY OF THE CONTENT

- Very abstract -- hard to visualize many of these if not all of these concepts
- Me -- I have to make sure that I read and re-read any activities or topics we discuss so I can help my kids understand.
- Information is over their level. [Pre-K]. Mainly an introduction to concept for my students.
- It depends on the grade level I get this school year. It varies from year to year. If i have more of the K-1, I will have to do a little more research and call on Ruth for help.
- I work with special needs kids, so I will have to use a 1st or 2nd grade level of teaching, even then I may have to go much slower with each lesson.

WORKING WITH TECHNOLOGY

- I think they might have challenges understanding how the solar panels covert the light into usable energy.
- Keeping voltage, amps, and watts used in the correct ways.
- Learning new technology

MISCONCEPTIONS

- Already established misunderstandings.
- Getting past pre-conceived idea.

VOCABULARY OR LANGUAGE

- Breaking outside their fears of not knowing the language.
- Learning new vocabulary.
- The language will be new to them so I will be preteaching some scientific vocabulary.

STUDENT MOTIVATION

- Not sure. My students come out of high school, some are uninterested students. The motivated students will have no problem learning.
- [Students] being motivated and enthusiastic to learn.

TIME

- Time -- I need to prioritize the best -- most impactful -- hands on activities to incorporate.
- Time ... not my curriculum
- Working with the limited classroom time we have together. I'm re-thinking how to involve family/friends and community into their learning projects at home.

NO CHALLENGES ANTICIPATED

- I do not anticipate any.
- I'm not sure
- Nothing.
- With a lot of review I think we will do well.

Item 4. What challenges to you anticipate facing as you try to teach solar science and solar energy to your students?

20 Responses

TIME

- [Figuring how to do] a little bit at a time.
- Finding the time to do all of it.
- Time

- Time
- Time to incorporate solar projects in the curriculum.
- Trying to fit the information into the current schedule.

MANAGING OR MOTIVATION STUDENTS

- Age level of children I work with [Pre-K teacher]
- Getting students excited!
- I think the challenges will be to teach solar energy in an engaging manner that is fun and educational.
- It depends on the age group as I stated above.
- Managing them and their excitement.

GETTING FUNDING OR APPROVAL

- The administrator of the school does not allow ""non-district approved"" materials to be used.
- $$$
- Local resources.
- Enough materials to teach solar science and solar energy.
- Providing enough equipment to provide a meaningful, hands-on experience for an entire class.

CONTENT OF THE MATERIAL

- My comfort level in explaining in terms my students understand [Pre-K].
- Remembering info.
- Will be trying to communicate to greater community, not just students. The challenge will be to bring it to laymen community.

NO CHALLENGES ANTICIPATED

- I am excited to use the info I learned in the classroom.
- I will review the materials before hand so I don't anticipate challenges.
- None.

Item 5. What part of the workshop did you find the most useful?

25 responses

HANDS-ON ACTIVITIES IN GENERAL

- All hands-on projects and sharing. It's really useful to see how these activities can play out in the classroom.
- Great hands-on projects
- Hands on
- Hands on activities
- Hands on activities.

- Hands on activity
- Hands-on activities
- Hands-on activities -- anecdotes
- Hands-on activities and going through the lessons and demos.
- Immediate hands on practice with the equipment.
- The classroom activities.
- The hands on activities to use in the classroom.
- The hands on projects and all the great materials that were given to us
- The hands-on projects and having them show us how it's done.

MATERIALS: FROM THE PRESENTATIONS AND FOR THE CLASSROOM

- All of the handouts. Looking forward to using them with my students.
- All the hands on because of language and able to understand.
- Distribution of products nice to see. I'll take advantage of the PowerPoint presentations on the flash drive..
- Materials are fabulous! Thanks so much.
- Receiving solar panels to use in the classroom.
- The wonderful supplies to implement in the classroom.
- There were a lot of valuable information and I couldn't absorb all but the reference will be a great tool to help and the people involved were also be able to help.

CONTENT

- Explanations concerning electricity.
- Magnetism info
- Most importantly all the new knowledge presented.
- Solar and eye of the sun.
- Solar energy into electricity because I feel I can now understand it.
- Solar energy stuff really good.
- Solar/sun –
- Sun earth connection

SPECIFIC ACTIVITIES

- Circuits
- Day one was very useful (The solar panel workshop).
- K-12 outreach and how to implement it
- Solar cooking
- Solar power using solar panels

EVERYTHING

- All of it! Fantastic!
- All of the training was great but
- All of the workshop

- Everything
- Everything
- Presenters are very skilled at presenting info in very accessible non-threatening way.

Item 6. What improvements to the workshop would you suggest?

MORE SCIENCE CONTENT

- I would enjoy more in depth science background, but would be difficult when working with the full range of K-12 teachers.
- I would like more science. In order to teach effectively the concepts must be more completely understood e.g., How do PVs work? Why is different Eu absorbed at different levels?

PACING OR LOGISTICS

- It sometimes seemed a little rushed.
- More space for the room
- PS Need ice for drinks.
- Sometimes it is worth our time to add one more day or even 1/2 day so things are so rushed. We need moving stuff in the late pm.

DO MORE OR MAKE THEM LONGER

- Add a third day -- so much fantastic information
- Just continue to offer these workshops to educators. It would really be great for all the new teachers at all grade levels.
- This was so awesome. Maybe one more day could be done. :)

NOTHING

- Loved it!
- None
- None -- great workshop
- None -- great workshop.
- Not sure I can think of any!
- Nothing -- this was one of the best work shops I have ever been to.
- Nothing. Fits the goals it seeks to achieve.

Appendix C: Survey Instrument

PART 1—Participant Characteristics

1. What is (are) the grade(s) of students that you teach?—check all that apply…

☐ K ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ 8 ☐ 9 ☐ 10 ☐ 11 ☐ 12 ☐ Other—specify_____

2. What is (are) the subject matter(s) that you teach? (Check all that apply)

☐ Art/music ☐ English/ language arts ☐ Foreign language ☐ Health ☐ Mathematics ☐ Science ☐ Technology

☐ Drama ☐ Engineering ☐ Guidance ☐ Media specialist/library ☐ Physical Ed ☐ Social studies ☐ Other—specify _____

3. You and your Institution (Check all that apply)

☐ Urban ☐ Public ☐ Private ☐ Rural ☐ Parochial ☐ Charter ☐ Suburban ☐ Other _____

4. Use the chart below to describe the composition of your class making sure that your percentages sum to 100%.

	Females	Males
African-American	%	%
Asian	%	%
Hispanic/Latino	%	%
White	%	%
Other	%	%

5. How many years have you been teaching—including this year? _____

6. Is your school a Title I school?
☐ Yes ☐ No

7. How many students do you teach in a typical year?
_____

8. With how many teachers do you anticipate sharing these materials/ideas? _____

PART 2—Post-Workshop Questions

9. Please rate today's workshop in the table below by checking the extent to which you 'agree' or 'disagree' with each statement…	Strongly Disagree	Disagree	In the middle	Agree	Strongly Agree
a. Prior to today, I had quite a bit of knowledge about the topics presented.	☐	☐	☐	☐	☐
b. Prior to today, I had used the topics presented as part of my curriculum or as a supplement to my basic curriculum.	☐	☐	☐	☐	☐
c. I will definitely present some of today's topics/materials to my students.	☐	☐	☐	☐	☐
d. I feel that I know enough about the topics to confidently present them to my students.	☐	☐	☐	☐	☐
e. I plan to use the topics/materials as an integral part of my basic curriculum.	☐	☐	☐	☐	☐
f. I plan to use the topics/materials as a supplement or resource to my basic curriculum.	☐	☐	☐	☐	☐
g. I will use the materials in teaching non-science topics (for example, literacy or technology.	☐	☐	☐	☐	☐
h. I will use the topics to train other teachers.	☐	☐	☐	☐	☐
i. I know enough about the topics to confidently present them to my colleagues in a workshop-type setting.	☐	☐	☐	☐	☐
j. I am certain that I will talk with colleagues about this workshop experience.	☐	☐	☐	☐	☐
k. I anticipate that there will be quite a few barriers that will make it difficult for me to implement these topics/materials.	☐	☐	☐	☐	☐
l. I think that I will need assistance while attempting to present these topics/materials to my students/colleagues.	☐	☐	☐	☐	☐
m. Knowing what I now know about this workshop, I would do it all over again.	☐	☐	☐	☐	☐

Post-Workshop Questions:

10. Which breakout session did you attend during the two-day workshop? Check one.
    - ☐ Eye on the Sky (elementary grades)
    - ☐ Living with a Star (middle and upper grades)

11. Did you come away from this two-day workshop with a new idea or new strategy that you want to include in your classroom practice? If so, can you describe your current thinking about this idea or strategy?

12. Did you notice points at which you could integrate solar science and solar energy that might help your students understand the topics? If so, can you describe your current thinking?

13. What *challenges* do you anticipate your students might have in learning about solar science and solar energy?

14. What *challenges* do you anticipate facing as you try to teach solar science and solar energy to your students?

15. *Overall*, how valuable do you feel this workshop has been to your ability to teach the topics of solar science and solar energy?

☐ Very valuable ☐ Moderately valuable ☐ Valuable ☐ Not that valuable ☐ Not valuable at all

Thank you for your time and your insights