

# **ENERGY CONNECTIONS**

## STUDENT SURVEY REPORT

Prepared by Amy Grack Nelson and Claire Philippe

February 6, 2009



SCIENCE MUSEUM OF MINNESOTA'S  
DEPARTMENT OF EVALUATION AND RESEARCH IN LEARNING

## Overview

During Fall 2008, the Science Museum of Minnesota’s outreach staff visited schools throughout northern Minnesota to deliver the Energy Connections program. The program had five learning goals:

1. Energy must come from somewhere, appears in many different forms, and can be changed from one form to another.
2. Technology used for harnessing and distributing energy often has drawbacks as well as benefits for the natural environment and all living things.
3. Electrical energy can be generated from a variety of sources, which can be either renewable or non-renewable, and can have different environmental consequences/impact.
4. People influence what decisions are made about technology and how energy sources are obtained, used, and transferred.
5. Decreasing the use of energy resources can reduce pollution, save money, and conserve limited resources.

A summative evaluation was carried out to gauge the impact the program had on students’ understanding of learning goals 3, 4 and 5. Students in fourth through sixth grade completed a post-survey after participating in the Energy Connections program (see Appendix A for post-survey). For the purpose of analysis, a random sample of 100 surveys was drawn from the completed surveys for each of the three grade levels, for a total of 300 surveys. The total number of responses (n) for each question is given by grade level in the tables below.

## Results & Discussion

### ***Student Experience***

Overall, students enjoyed the Energy Connections program (see Table 1). Fourth graders rated their level of enjoyment highest, with two-fifths strongly agreeing with the statement, “I enjoyed the Energy Connections Program.” As students got older, fewer strongly agreed with the statement. Compared to the 2007 evaluation, fourth and fifth graders’ ratings remained similar, while more sixth graders strongly agreed with the statement in 2007 compared to 2008 (See Appendix B).

*Table 1: Agreement with “I enjoyed the Energy Connections Program.”*

	4 <sup>th</sup> Grade (n=99)	5 <sup>th</sup> Grade (n=100)	6 <sup>th</sup> Grade (n=100)
Strongly Agree	42%	36%	18%
Agree	<b>54%</b>	<b>53%</b>	<b>74%</b>
Disagree	1%	8%	6%
Strongly Disagree	3%	3%	2%

The Energy Connections program was easy for most students to understand, however a majority of students agreed instead of strongly agreed with the statement, “The Energy Connections Program was easy to understand” (see Table 2). Fourth graders found the program more difficult to understand than students in older grades, with over a quarter disagreeing or strongly disagreeing with the statement. When comparing ratings to the 2007 evaluation, more students

across all grade levels expressed difficulty understanding the program in 2008 than 2007 (See Appendix B).

*Table 2: Agreement with “The Energy Connections Program was easy to understand.”*

	4 <sup>th</sup> Grade (n=99)	5 <sup>th</sup> Grade (n=99)	6 <sup>th</sup> Grade (n=100)
Strongly Agree	16%	16%	32%
Agree	<b>55%</b>	<b>69%</b>	<b>49%</b>
Disagree	28%	13%	18%
Strongly Disagree	1%	2%	1%

### **Renewable and Non-renewable Energy Sources**

One of the program’s goals was for students to learn that electrical energy can be generated from a variety of sources, which can be either renewable or non-renewable (Learning Goal 3). Students were asked to provide a definition of renewable and non-renewable energy sources.

Students’ definitions of renewable energy sources were coded based on if they were correct or incorrect. As illustrated in Table 3, correct responses fit under the theme “It can be used again and again” or “It won’t run out.” Incorrect and don’t know responses were grouped together. Over three-quarters of all students were able to correctly define a renewable energy source. Students from all grade levels most frequently defined a renewable energy source as one that can be used again and again.

*Table 3: Definition of renewable energy*

Theme	4 <sup>th</sup> Grade (n=98)	5 <sup>th</sup> Grade (n=96)	6 <sup>th</sup> Grade (n=100)
It can be used again and again	<b>67%</b>	<b>71%</b>	<b>63%</b>
It won’t run out	8%	5%	15%
Incorrect/I don’t know	24%	24%	22%

Students’ definitions of non-renewable energy sources were coded based on if they were correct or incorrect. As illustrated in Table 4, correct responses fit under the theme “You can’t use it again and again” or “Once it is used up we cannot get more.” Any other response was considered incorrect. Over three-quarters of all students were able to correctly define a non-renewable energy source. The most frequent response for all grade levels was “You can’t use it again and again.”

*Table 4: Definition of non-renewable energy*

Theme	4 <sup>th</sup> Grade (n=97)	5 <sup>th</sup> Grade (n=97)	6 <sup>th</sup> Grade (n=100)
You can’t use it again and again	<b>62%</b>	<b>66%</b>	<b>45%</b>
Once it is used we cannot get more	19%	13%	33%
Incorrect/I don’t know	19%	21%	22%

Students were also asked to provide an example of one renewable energy source and one non-renewable energy source. During the Energy Connections Program wind, sun and water were

presented as renewable energy sources. Non-renewable energy sources were nuclear energy and fossil fuels like coal and oil. For renewable sources of energy, fourth and fifth grade students most frequently mentioned the sun or solar energy while sixth grade students most frequently mentioned water or hydroelectric energy as shown in Table 5. Around half the students in each grade were unable to name a renewable energy source.

*Table 5: Examples of a renewable energy source.*

Theme	4 <sup>th</sup> Grade (n=92)	5 <sup>th</sup> Grade (n=91)	6 <sup>th</sup> Grade (n=97)
Sun	<b>23%</b>	<b>29%</b>	9%
Water	11%	11%	<b>24%</b>
Wind	13%	14%	13%
Incorrect/I don't know	52%	47%	54%

Across grades, the most frequent example of a non-renewable energy source was coal and the second most frequent example was oil. Table 6 shows the frequency of examples by grade. A little over a third of students in fourth and sixth grade were unable to name a non-renewable energy source, while almost half of fifth graders were unable to do so.

*Table 6: Examples of a non-renewable energy source*

Theme	4 <sup>th</sup> Grade (n=87)	5 <sup>th</sup> Grade (n=93)	6 <sup>th</sup> Grade (n=96)
Coal	<b>39%</b>	<b>44%</b>	<b>43%</b>
Oil	23%	8%	19%
Fossil Fuels (didn't specify)	1%	2%	3%
Nuclear	0%	0%	1%
Incorrect/I don't know	36%	47%	34%

### **Energy Conservation Behaviors**

Students were asked to gauge their understanding of energy conservation behaviors before seeing the Energy Connections program. As illustrated in Table 7, a majority of students in all grades agreed or strongly agreed that they had a strong prior understanding of energy conservation behaviors.

*Table 7: Agreement with "Before the Energy Connections program, I had a strong understanding of things I can do to conserve or save electricity."*

	4 <sup>th</sup> Grade (n=99)	5 <sup>th</sup> Grade (n=99)	6 <sup>th</sup> Grade (n=99)
Strongly Agree	35%	23%	29%
Agree	<b>44%</b>	<b>56%</b>	<b>52%</b>
Disagree	16%	16%	17%
Strongly Disagree	4%	4%	2%

Students were asked to describe two new things they learned about ways they can conserve or save electricity. As illustrated in Table 8, a majority of students in fifth and sixth grade were able to list two correct conservation behaviors (see themes listed in Table 9). Two-thirds of the sixth grade students cited two correct reasons to conserve electricity. As grade level decreased, the percentage of students providing two correct answers also decreased, with a quarter of fourth graders failing to provide any correct answers. Overall, fewer students provided correct responses compared to the 2007 evaluation. In 2007, more than 70% of students in each grade were able to provide two correct responses and only 1% of fourth graders were unable to provide any correct answers (See Appendix B).

*Table 8: Number of correct energy conservation behaviors*

	4 <sup>th</sup> Grade (n=85)	5 <sup>th</sup> Grade (n=98)	6 <sup>th</sup> Grade (n=99)
Two Correct Answers	<b>47%</b>	<b>54%</b>	<b>66%</b>
Only One Correct Answer	26%	30%	23%
No Correct Answers	26%	13%	10%
Didn't Learn Anything New	1%	3%	1%

Students' correct responses were coded into themes. Table 9 shows theme frequency from students who had at least one correct answer. Turning off the lights was the most frequently mentioned conservation behavior across all grade levels.

*Table 9: Correct ways to conserve or save electricity*

Theme	4 <sup>th</sup> Grade (n=62)	5 <sup>th</sup> Grade (n=82)	6 <sup>th</sup> Grade (n=88)
Turn off lights	<b>71%</b>	<b>88%</b>	<b>80%</b>
Use different (CFL) light bulbs	26%	12%	47%
Other (Correct)	19%	20%	17%
Use less hot water	19%	18%	11%
Use electric things less (lights, TV, etc.)	15%	18%	10%
Turn off things other than lights	5%	7%	6%
Clean full loads	0%	6%	3%
Bike or walk	10%	0%	1%
Shut the refrigerator door	0%	2%	3%
Shut the front door	1%	1%	1%

### **Reasons to Reduce Electricity Use**

Before seeing the Energy Connections program, students were asked to gauge their understanding of why people should reduce the amount of electricity they use. As illustrated in Table 10, students in all grades rated themselves similarly on their prior knowledge. Over three quarters agreed or strongly agreed with the statement, “Before the Energy Connections program, I had a strong understanding of why people should reduce the amount of electricity they use.”

*Table 10: Agreement with “Before the Energy Connections program, I had a strong understanding of why people should reduce the amount of electricity they use.”*

	4 <sup>th</sup> Grade (n=98)	5 <sup>th</sup> Grade (n=98)	6 <sup>th</sup> Grade (n=99)
Strongly Agree	31%	25%	<b>38%</b>
Agree	<b>49%</b>	<b>50%</b>	<b>38%</b>
Disagree	18%	19%	19%
Strongly Disagree	2%	6%	4%

Students were asked to think about what they learned in the Energy Connections program and provide two reasons why people should reduce the amount of electricity they use. As illustrated in Table 11, half of sixth graders and around two-fifths of fifth graders were able to provide two correct reasons to reduce electricity use (see themes listed in Table 12). However, less than a third of fourth grade students provided two correct answers.

*Table 11: Number of correct reasons to reduce electricity use.*

	4 <sup>th</sup> Grade (n=85)	5 <sup>th</sup> Grade (n=98)	6 <sup>th</sup> Grade (n=99)
Two Correct Answers	28%	<b>42%</b>	<b>51%</b>
Only One Correct Answer	<b>51%</b>	38%	33%
No Correct Answers	22%	18%	16%
Didn't Learn Anything New	0%	1%	0%

Students' correct responses were coded into themes. Table 12 shows theme frequency from students who had at least one correct answer. In all grades, students most frequently cited saving money as a reason to reduce electricity use.

*Table 12: Correct reasons to reduce electricity use*

Theme	4 <sup>th</sup> Grade (n=66)	5 <sup>th</sup> Grade (n=78)	6 <sup>th</sup> Grade (n=82)
Save money	<b>62%</b>	<b>58%</b>	<b>74%</b>
Good for the environment/less pollution	37%	33%	38%
Save energy in general	32%	32%	24%
So we don't run out of electricity in the future	27%	18%	16%
So we don't run out of fossil fuels	6%	21%	16%
Other (Correct)	0%	3%	5%

# Summary of Findings

## ***Program Experience***

- Overall, students enjoyed the Energy Connections program.
- The program was easy for most students to understand; however fourth graders found the program more difficult to understand than students in older grades. When comparing ratings to the 2007 evaluation, more students across all grade levels expressed difficulty understanding the program in 2008 than 2007

## ***Learning Goal 3: Renewable and Non-renewable Energy Sources***

- Over three-quarters of students in fourth, fifth, and sixth grade were able to correctly define renewable and non-renewable energy sources.
- Only around half of all students (fourth 48%, fifth 53%, sixth 46%) were able to name a renewable energy source.
- Around two-thirds of fourth and sixth grade students were able to name a non-renewable energy source, while only around half of fifth graders (53%) could do so.

## ***Learning Goal 4: Energy Conservation Behaviors***

- A majority of students in fifth (54%) and sixth grade (66%) were able to list two correct conservation behaviors. As grade level decreased, the percentage of students providing two correct answers also decreased, with a quarter of fourth graders failing to provide any correct answers.
- Overall, fewer students were able to cite correct conservation behaviors in 2008 compared to the 2007 evaluation. In 2007, more than 70% of students in each grade were able to provide two correct responses and only 1% of fourth graders were unable to provide any correct answers
- Turning off the lights was the most frequently mentioned conservation behavior across all grade levels.

## ***Learning Goal 5: Reasons to Conserve Electricity***

- Half of sixth graders and around two-fifths of fifth graders were able to provide two correct reasons to reduce electricity use. Less than a third of the fourth graders were able to do so.
- In all grades, students most frequently cited saving money as a reason to reduce electricity use.

# Appendix A

## Energy connections program: Student post-survey

Please take a few minutes to let us know what you thought about the Science Museum Energy Connections program and what you learned from it. Your answers will be used to help us improve future school programs. Thank you for your help!

---

---

**1. Rate your experience with the Energy Connections Program. For each of the following, indicate how much you agree or disagree with the statement.**

	Strongly Disagree	Disagree	Agree	Strongly Agree
a. I enjoyed the Energy Connections Program.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. The Energy Connections Program was easy to understand.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Before the Energy Connections program, I had a strong understanding of things I can do to conserve or save electricity.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Before the Energy Connections program, I had a strong understanding of why people should reduce the amount of electricity they use.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**2. What does it mean if an energy source is renewable?**

---

---

**3. What does it mean if an energy source is non-renewable?**

---

---



**4. Name one renewable and one non-renewable energy source used for creating electricity.**

**Renewable Energy Source:** \_\_\_\_\_

**Non-Renewable Energy Source:** \_\_\_\_\_

**5. Describe two new things you learned about ways you can conserve or save electricity.**

**1)**

---

---

**2)**

---

---

**6. Thinking about what you learned in the program, what are two reasons why people should reduce the amount of electricity they use?**

**1)**

---

---

**2)**

---

---

**Tell us a little bit about yourself...**

**7. What is the name of your school?**

---

**8. What grade are you in?**

- 4<sup>th</sup> grade
- 5<sup>th</sup> grade
- 6<sup>th</sup> grade

## Appendix B: Comparison of responses (2007/2008)

*Table 13: Agreement with “I enjoyed the Energy Connections Program.”*

	4 <sup>th</sup> Grade		5 <sup>th</sup> Grade		6 <sup>th</sup> Grade	
	2007 (n=75)	2008 (n=99)	2007 (n=75)	2008 (n=100)	2007 (n=75)	2008 (n=100)
Strongly Agree	44%	42%	41%	36%	35%	18%
Agree	<b>51%</b>	<b>54%</b>	<b>55%</b>	<b>53%</b>	<b>61%</b>	<b>74%</b>
Disagree	5%	1%	4%	8%	4%	6%
Strongly Disagree	0%	3%	0%	3%	0%	2%

*Table 14: Agreement with “The Energy Connections Program was easy to understand.”*

	4 <sup>th</sup> Grade		5 <sup>th</sup> Grade		6 <sup>th</sup> Grade	
	2007 (n=75)	2008 (n=99)	2007 (n=75)	2008 (n=99)	2007 (n=75)	2008 (n=100)
Strongly Agree	28%	16%	41%	16%	35%	32%
Agree	<b>57%</b>	<b>55%</b>	<b>59%</b>	<b>69%</b>	<b>60%</b>	<b>49%</b>
Disagree	5%	28%	8%	13%	3%	18%
Strongly Disagree	0%	1%	0%	2%	0%	1%

*Table 15: Number of correct energy conservation behaviors*

	4 <sup>th</sup> Grade		5 <sup>th</sup> Grade		6 <sup>th</sup> Grade	
	2007 (n=74)	2008 (n=85)	2007 (n=69)	2008 (n=98)	2007 (n=75)	2008 (n=99)
Two Correct Answers	<b>78%</b>	<b>47%</b>	<b>80%</b>	<b>54%</b>	<b>71%</b>	<b>66%</b>
Only One Correct Answer	19%	26%	14%	30%	25%	23%
No Correct Answers	1%	26%	6%	13%	4%	10%
Didn't Learn Anything New	1%	1%	0%	3%	0%	1%