2010-2011 Program Evaluation: *Ice, Ice Baby!*

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The Center for Remote Sensing of Ice Sheets (CReSIS) is a Science and Technology Center established by the National Science Foundation (NSF) in 2005. Our mission is to develop new technologies and computer models to measure and predict the response of sea level change to the mass balance of ice sheets in Greenland and Antarctica. CReSIS develops and offers education outreach programs to K-12 students, science teachers, and undergraduate and graduate students. One of the education goals is to contribute to the development of the next generation of scientists and engineers, particularly from underrepresented groups. As part of our K-12 outreach programs, CReSIS developed the Ice Ice Baby (IIB) program, which is a series of twenty inquiry-based lessons. Ms. Cheri Hamilton, the CReSIS K-12 Outreach Coordinator, leads the IIB program by teaching 30-60 minute climate and polar science lessons at elementary and middle schools around the Kansas City, Topeka, and Lawrence areas. During the 2010-2011 school year, Ms. Hamilton presented at eight urban elementary classrooms in three different schools each month. In comparison to state demographics, these schools have disproportionately high percentages of minority students from low-income families. In total, an average of 158 students from the 3rd, 4th, and 5th grades participated in the program. During the school year, IIB contributed additional science lessons for each student who participated.

Introduction

The main goal of the Ice Ice Baby program is to provide elementary students with basic science knowledge about polar science and to inspire these students’ interest in both science and science careers. In the long run, this effort may contribute to producing a greater number of future scientists and engineers. Additionally, this program provides underrepresented minority students with opportunities to experience high-quality science education. Finally, it is our hope that the Ice Ice Baby program will foster our teachers’ progression toward more engaging science instruction.
During the 2010 to 2011 school year, Ms. Hamilton taught Ice Ice Baby to 83 students at Whittier Elementary, 48 students at Lowman Hill Elementary, and 27 students at Lundgren Elementary. The three elementary schools’ minority student populations are much higher than the state average, and the demographics of each school are provided in the pie charts below.

**State of Kansas K–12 Demographics (2010–2011)**

**Demographics of Surveyed Elementary School:**

- **Whitter, Kansas City, KS**
  - White: 71%
  - Hispanic: 15%
  - African-American: 7%
  - Other: 7%

- **Lowman Hill, Topeka, KS**
  - White: 45%
  - Hispanic: 26%
  - African-American: 27%
  - Other: 2%

- **Lundgren, Kansas City, KS**
  - White: 49%
  - Hispanic: 47%
  - African-American: 3%
  - Other: 1%

**LEGEND**
- White
- Hispanic
- African-American
- Other
Evaluation Overview

To determine how well the Ice Ice Baby program meets its stated objectives, two primary evaluation plans were designed and administered by the CReSIS Education team; they are described below. The Pre and Post Student Attitude toward Science Surveys were distributed by the classroom teachers, and the Teacher Surveys were distributed by Ms. Hamilton.

1. Pre and Post Student Attitude toward Science Surveys: All participating students take a Likert-scale survey to determine their attitude toward science both before beginning the IIB program and at the end of the program. This survey includes nine questions; every question may be answered with one of three choices on a predetermined scale.

2. Teacher Survey: In addition to the Student Attitude toward Science Surveys, a Teacher Survey is also administered to evaluate the effectiveness of the Ice Ice Baby program from the teachers’ perspectives. More importantly, this survey allows us to determine whether the Ice Ice Baby program has any significant effect on participating teachers’ science teaching. This survey contains eight single-choice questions and one open-ended question.
Results: Student Perspectives

The results of the Pre and Post Student Attitude toward Science Surveys indicate that the students’ attitudes toward science generally improved between the beginning and end of their participation. The percentage of students reporting positive and very positive attitudes toward science has increased from a range of 0.6% to 7.7% (See Table 1). Even though there is a slight decrease (negative 1.9% and 1.3%) in the last two questions, the results of the other five questions show that students’ attitudes toward science have been positively affected by participation in the Ice Ice Baby program.

It is worth noting that the two highest positive increases (7.7% and 5.1%) pertain to the questions “I like to visit websites about science” and “I wonder what it would be like to be a scientist”. Both of these results are strong indicators of the effect of increasing student interest in science and increasing student curiosity and aspiration toward science careers. These indicators directly reflect the goal of inspiring these students to learn more about science and science career paths. Finally, there was a 4.5% increase in student participation in science activities at home, which shows a general greater interest in science, even outside of school.

Although the mean difference of the Pre and Post Surveys is relatively small, with a decrease from 0.01 to 0.10, these statistics may not tell the whole story. There are a variety of reasons that may explain the negative statistics. First, as shown in Figure 3, the mean of the Pre Survey for all questions is relatively high, which could mean that students at these three schools already had positive attitudes toward science before the Pre Survey. Also, the sample mismatch between Pre and Post Surveys could negatively affect the result. For example, at Lowman Hill elementery school, 92 students finished the Pre Surveys, but only 43 students completed the Post Surveys. Therefore, the mean difference may be statistically better if we could locate the missing students and include their data in the Post Survey.

<table>
<thead>
<tr>
<th>Pre and Post Survey n = 156</th>
<th>Mean Difference between PRE - POST Surveys</th>
<th>Percentage of Students Reporting a Positive and Very Positive Attitude Toward Science</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PRE</td>
<td>POST</td>
</tr>
<tr>
<td>Science is fun to do</td>
<td>2.61</td>
<td>2.62</td>
</tr>
<tr>
<td>I like to read books or magazines about science</td>
<td>1.90</td>
<td>1.91</td>
</tr>
<tr>
<td>I like to watch science programs on T.V.</td>
<td>2.08</td>
<td>2.11</td>
</tr>
<tr>
<td>I wonder what it would be like to be a scientist</td>
<td>1.91</td>
<td>1.99</td>
</tr>
<tr>
<td>I’d like to find out more about science careers</td>
<td>2.39</td>
<td>2.38</td>
</tr>
<tr>
<td>I do science experiments at home</td>
<td>2.15</td>
<td>2.16</td>
</tr>
<tr>
<td>I’m interested in taking more science in school</td>
<td>1.74</td>
<td>1.84</td>
</tr>
<tr>
<td>I’d like to have a career in science</td>
<td>2.59</td>
<td>2.37</td>
</tr>
</tbody>
</table>

Ice Ice Baby
Student Attitude Toward Science Survey
PRE/POST (n=156)
Results: **Teachers’ Perspectives**

From the teachers’ perspectives, the Ice Ice Baby program is successful and effective. All of the teachers surveyed strongly agreed that Ice Ice Baby provides significant educational value to their students and that their students enjoy Ms. Hamilton’s classes. Also, all teachers agreed that IIB increased their students’ interest in polar science. Regarding the goal of improving teachers’ science instruction, the results are also quite positive. More than 80% of participating teachers integrated the supplemental materials CReSIS provided into their lessons.

Interestingly, only 32% of teachers agreed with the statement in question six, “I have my students use the student science journals for science lessons other than the Ice, Ice Baby lessons”. However, the explanation was provided in the open-ended question responses by one teacher: “I disagreed with number six because we are currently utilizing science notebooks for National Geographic, therefore, all work that we do must be added to those notebooks”. In addition, more than 60% of teachers surveyed intend to participate in the pilot-testing of new CReSIS polar science curricular materials and to attend professional development workshops hosted by CReSIS. These results show a strong interest in CReSIS and a commitment to improving their science instruction using CReSIS resources.

Finally, the open-ended questions provided additional evidence of the positive effects of Ice Ice Baby and suggestions for improvement.

**Here are some teacher quotes:**

- “This program is very beneficial for our students. Our current curriculum that we are implementing does not cover this type of science.”
- “The students are actively engaged in learning activities that have increased their knowledge and interest in science.”
- “Last year, we used the Ice, Ice, Baby notebooks to add additional science leanings.”
- “There is little that I would suggest to improve the outreach because Ms. Hamilton does an excellent job and really brings materials and activities that stimulate and interest the students.”

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**Teachers’ Response Pattern**

| Ice, Ice Baby is of significant educational value to my students. | 100.0% (6) |
| My students enjoy Ms. Hamilton’s presentations. | 100.0% (6) |
| My students’ interest in polar science is piqued by the presentation. | 66.7% (4) |
| I integrate the supplementary materials provided by CReSIS into my lessons between Ms. Hamilton’s visits. | 50% (3) |
| I have my students complete the science journal entries. | 66.7% (4) |
| I have my students use the student science journals for science lessons other than the Ice, Ice Baby lessons. | 16.7% (1) |
| I would be interested in participating in the pilot-testing of new CReSIS polar science curricular materials. | 66.7% (4) |
| I would be interested in attending a professional development workshop at KU’s Center for Remote Sensing of Ice Sheets | 16.7% (1) |

**LEGEND**

- **Strongly Agree**
- **Agree**
- **Disagree**
- **Strongly Disagree**
Conclusion

Based on the survey analysis, it is safe to conclude that the Ice Ice Baby K-12 program remains largely successful in exposing a diverse group of students and teachers to CReSIS-related science. Not only did participating students improve their attitudes toward science, but their teachers also received professional development. Moreover, the evaluation results confirm that participation in the IIB program increases student interest in science. Meanwhile, teacher professional development is also closely connected with participation in the Ice Ice Baby Program. To provide better service to targeted student populations, the teachers suggested that CReSIS provide more educators and more frequent visits. The CReSIS Education team will continue to consider ways to expand our K-12 outreach efforts. We will also consider evaluation revisions to ensure program efficiency and accuracy of survey results; for example, we would like to find ways to better track IIB participant attrition and retention to ensure statistically precise survey results.