



MULTIMEDIA RESEARCH

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Antarctica's Climate Secrets Easton Flexhibit Site Observations October 4 & 9, 2007



Report for
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Photo: Flexhibit Banner, Unit 1

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Antarctica's Climate Secrets

Site Observations

October 4th & 9th, 2007

Introduction

Sixth and seventh grade students at Easton Middle School in Easton, Maryland, are participating in after-school activities about Antarctica and how geoscientists there are gathering clues about Earth's climate. The activities will be the basis for a public science event in November, 2007. Observations of the after-school sessions and student interviews were performed on October 4th and 9th, 2007, to obtain feedback in the fourth and fifth of ten 90-minute sessions collectively titled, "*Flexhibit Activity Sessions*." Specifically, research efforts focused on obtaining feedback from students about their performance of the three activities contained in Unit 2 (*Antarctica's Ice on the Move*) of the *Antarctica's Climate Secrets Activity Guide* (Draft materials dated August 28, 2007). The activities in this unit are intended to convey the idea that different parts of Antarctica's immense ice sheet are moving at different speeds and in different directions, all under the force of gravity. Students are also expected to learn that around the edges of the continent, the solid ice sheets flow/move off the land and extend out over the ocean.

Flexhibit activities were performed in a science classroom (approx. 40 ft. x 96 ft.) with desks (seating a total of 25 students) facing a blackboard, computer, and projection screen on one third of the room and seven lab tables with sinks and faucets located in the other two-thirds of the room. Students divided themselves into three groups, with each group seated on stools at their own lab table. A site coordinator (Stacey Hofmann, Extension Educator, 4-H & Youth Development) and three middle school teachers led the observed sessions. One of the session leaders is a science teacher (female), and two of the leaders are social studies teachers (1 male, 1 female).

October 4th Observations (3:00–4:30 p.m.)

Of the twelve students (4 male, 8 female) participating in *Flexhibit* activities on this date, five are in sixth grade and seven are in seventh grade. Six of the students are Caucasian, four are African American, and two are Asian. The site coordinator took the role of session leader while the three teachers attended a required principal's meeting during the first half of the session.

Research efforts on this date focused on obtaining feedback from participating students about their performance of Activity 2B (*Make a Glacier Flip-Book*) and preparation for Activity 2A (*Make a Model Glacier*), to be completed the following Tuesday (October 9th). The day's schedule was divided into the following five activities:

1. Construct glacier models for Activity 2A (to be completed Oct. 9th)
2. Perform Activity 2B
3. Teacher led questions and discussion
4. Presentation of project banners by LuAnn Dahlman
5. Review

The following are findings and recommendations from this site observation:

Activity 2A: Make a Model Glacier (3:00–3:30 p.m.)

Following the four-step procedure described in the printed instructions for Activity 2A (Page 66 in the *Activity Guide*), each of the three student groups made a model glacier from shaved/crushed ice. The glacier models, which are intended to show how glaciers form an ice sheet, were put into a refrigerator located in an adjacent room to freeze solid for use in the completion of the activity on October 9th.

The students were very engaged, enthusiastic, and cooperative during this activity. Group discussions generally related to the task. The session leader visited lab tables taking the role of a guide-on-the-side or facilitator. Some of the students displayed a lack of full understanding regarding the process of layering in glaciers described in the *Preview* (i.e., alternating thick white winter snow layers and a thin dark summer layer containing snow/ice mixed with dust and pollutants). The site coordinator reported that students read the *Preview* (Page 65) in the preceding session, two days earlier. While the session leader discussed the process with the students as questions arose, a better understanding may have resulted from a reading or review of the annual layering process described on the *Preview* page immediately prior to model making. Perhaps this should be listed as step one in the instructions.

Activity 2B: Make a Glacier Flip-Book (3:30–4:00 p.m.)

Activities proceeded to Activity 2B, with students reading the *Preview* and instructions for Activity 2B (Page 69).¹ While some students appeared to read the *Preview*, others skipped it and began the activity after reading only the instructions. The hands-on activity involved cutting out twenty pictures of a glacier and stacking them to create flip-book pages. Each low-resolution black-and-white picture measures $2\frac{1}{8}$ " x $2\frac{3}{4}$ ".

Students were very engaged. They discussed the flip-book, kept busy, and appeared to enjoy the task. Each of the session leaders, who had now returned from the principal's meeting, discussed the task with students. Each of them worked independently with a group for a few minutes and then rotated to a different group/lab table. They checked students' understanding and answered questions.

Upon completion and testing of the flip-books, it became apparent that students had great difficulty discerning the downhill motion of the glacier, as evidenced by the following representative remarks by students:

- *"I didn't see it move at all."*
- *"It's there and then it's there again in the next picture. Nothing changed."*
- *"It didn't work."*

¹ Note that in the activity text, sometimes the term flip-book is hyphenated, sometimes it's two words (i.e., flip book), and sometimes it's one word (i.e., flipbook).

- *“I couldn’t see the glacier move.”*
- *“It didn’t really work.”*
- *“I saw some dots move in the mountains, but not the glacier.”*

The main point of Activity 2B is to learn that solid ice flows/moves downhill, albeit rather slowly. Students appear to form the idea that it’s an annual cycle of melting and refreezing that extends a glacier rather than solid ice flowing downhill under the force of gravity. Perhaps this notion is planted or reinforced by the following sentences contained in Activity 2A’s *Preview*: “Small amounts of liquid water trickle down to the land below the snow. When this liquid water refreezes and expands, rocks from the surface of the land get frozen into the ice at the bottom of the glacier.”

Group Discussion (4:00–4:10 p.m.)

One of the session leaders (male social studies teacher) asked students the ‘ponder’ questions on Page 70 of the *Activity Guide*. The group discussed the activity, after which the leader explained and summarized the key ideas.

LuAnn Banner Presentation (4:10–4:25 p.m.)

LuAnn Dahlman discussed information contained on each of the following five banners (Draft banners dated August 2007):

- Banner 1: Antarctica Today
- Banner 2: Antarctica’s Ice on the Move
- Banner 3: Reading Antarctica’s Rock Cores
- Banner 4: Tiny Clues to Antarctica’s Past
- Banner 5: Decoding Antarctica’s Climate History

Students displayed no difficulty answering questions that she asked about banner content. With regards to Banner 5, however, while the students were generally able to “decode” Antarctica’s history of warming and cooling and extrapolate its future climate based on the current warming trend, they were unable to offer any explanation or theory about why this might be occurring. Their understanding is evidenced by students’ responses when Ms. Dahlman asked “Does anything on this banner indicate to you what Antarctica’s climate might be like in the future?” The following are representative remarks:

- *“I think it’s going to be warmer because it’s sort of going in a pattern. It’s going warm-cold-warm-cold.”*
- *“I think it’s going to be really warm. It’s going to be like it was 50-40 million years ago or maybe 35-30 million years ago.”*
- *“I think it’s going to get warmer.”*
- *“It will get warmer.”*

In contrast, two of the students were unable to extrapolate the future of Antarctica’s climate from the banner’s images. One student was uncertain if the landscapes shown on the banner are depicting the same location.

Review (4:25–4:30 p.m.)

The site coordinator reviewed the main issues/ideas and outcomes related to the day’s activities.

Interview Responses

Over the course of the day's activities, the observer performed one-on-one interviews with eleven of the twelve participating students. The students were asked to provide oral responses to six interview questions. Time did not allow for the final interview when one of the leaders unexpectedly called all of the students together to participate in a group discussion, which was immediately followed by the banner presentation.

Examination of students' responses reveals that they were able to describe today's hands-on activities. They are enjoying the *Flexhibit Activity Sessions* and performing the activities is not problematic, so far. Each of them also reports having learned new information and ideas about Antarctica. With regards to how confident they feel about making a presentation at the *Flexhibit Event* in November, students are reportedly acquiring ample knowledge that they can share with others. However, some of them expressed a feeling of nervousness about speaking in front of an audience. Perhaps students should be asked to make a brief presentation a couple of times over the course of the ten sessions in order to acquire practice and guidance/feedback in a less stressful environment. Helpful ideas about public speaking may also be included in the *Activity Guide*. The following are students' actual interview responses. (Note the consistency across remarks.):

1. What are you working on?

- *"We're working on cutting out pictures of glaciers and things. And, we did a project where we used things like pepper, ice, a bowl and that kind of stuff to make a glacier."*
- *"I'm making a flip-book that shows how different the glaciers look when they move over a long time. You can tell the difference when they move downhill. We're also making a glacier with crushed ice and pepper."*
- *"We're making a flip-book of glaciers and how they're formed. We also made a glacier out of ice and pepper and then we pressed it down to make it more solid."*
- *"I'm working on making a flip-book and we made glaciers."*
- *"We're making glaciers and a glacier flip-book."*
- *"I'm learning about the glaciers in Antarctica. We made a model of a glacier using ice and pepper. Then we made flip-books that let you see how glaciers move."*
- *"We're making a glacier and flip-book."*
- *"Making a model of a glacier and seeing a glacier move downhill."*
- *"Glacier models and glacier flip-books."*
- *"Our group made a glacier that we're going to use next week. Then we each made a glacier flip-book."*
- *"We're learning about Antarctica and the glaciers there."*

2. Are you enjoying what you are doing?

- *"Yes. I would like to come here until I graduate."*
- *"Yeah. It's a lot of fun. I like making things to learn."*
- *"Uh huh. I like it a lot. It's really fun to do. I'm learning a lot."*
- *"Yes. It's interesting. I've been excited because I love hands-on activities."*
- *"Yes I am. I would describe it as something that's good for you when you get older, like for college. And, it's fun to talk about with your friends"*
- *"Yes, hands-on activities are fun ways to learn."*

- *“Yes. I would rate this activity as 9 on a 10 point scale.”*
- *“Yes.”*
- *“Making the glacier is really fun. I’m learning a lot of things.”*
- *“Yeah. I didn’t know anything about Antarctica before.”*
- *“I like it. I like making stuff. I don’t like people just telling me stuff. I want to do stuff with my hands and learn by experimenting.”*

3. Are you having any difficulty?

- *“No, I’m not having any difficulty.”*
- *“No.”*
- *“No, they’re all good. It’s not too hard.”*
- *“Not so far.”*
- *“No it’s not. All of the activities we’ve done are interesting and fun to do.”*
- *“No.”*
- *“No. It just took a lot of time to cut out the pictures for the flip-book.”*
- *“No.”*
- *“I haven’t had any difficulty.”*
- *“No.”*
- *“No.”*

4. Do you have any ideas that could make the activity better?

- *“No. It’s already good the way it is.”*
- *“It’s already fun to learn.”*
- *“No. I think they’re all good and they’re all fun. I think they’re perfect.”*
- *“No. I liked all of the activities.”*
- *“No, they’re fun enough already.”*
- *“No.”*
- *“No, it’s going well.”*
- *“No.”*
- *“I think the activities are okay now.”*
- *“Not that I can think of.”*
- *“No.”*

5. What have you learned from working on this project?

- *“I learned what a glacier is and that glaciers move downhill. Antarctica is dry and much of the Earth’s fresh water is Antarctic ice.”*
- *“I’m learning about Antarctica and that 70% of the world’s fresh water is in Antarctica in the ice.”*
- *“A lot about Antarctica, like it’s the driest, and windiest, and coldest continent on Earth. I used to think it was wet with all the snow.”*
- *“I’ve learned how glaciers formed, what they do, and a lot of other things about Antarctica, like stuff about blubber and sea ice.”*
- *“I learned that Antarctica is the coldest, windiest, and driest place on Earth. I’ve also learned about penguins and that it has more fresh water ice than anyplace else in the world”*
- *“I’ve learned how glaciers are formed by making a model of a glacier with ice and pepper. Antarctica gets bigger and small because the ice melts every year.”*
- *“I learned how deep the ice is in Antarctica and how cold it is there. Looking at the posters I think it’s probably going to change.”*
- *“A lot more than I knew. I didn’t know there was such a thing as sea ice and other things like that.”*
- *“I’m learning everything about Antarctica and animals that live there.”*

- *"I learned about how dry, windy, and cold it is in Antarctica. I learned that there is sea ice, glaciers, and an ice shelf.*
- *"There are seals, penguins, and whales in Antarctica. Blubber and fur keep them warm.*

6. How confident are you that you can clearly explain this activity to someone else?

- *"I feel good because I'm used to talking to a lot of people. I help my mom and grandmother do things and talk to people to help the community. I'm also learning things here that I can explain to people."*
- *"I'm not ready yet because talking in front of people makes me nervous. I'm learning things and know what to say, but the talking isn't easy for me."*
- *"I feel confident because I understand what we're learning."*
- *"I'm not really sure yet about getting up in front of people, but I know the information. I'm just nervous about being in front of a group of people."*
- *"I'm comfortable. I'm learning a lot that I can talk about."*
- *"Pretty confident."*
- *"I think I can do that."*
- *"From one to ten I guess seven, mostly because I get nervous doing that. I'm learning things to say, but I still feel nervous."*
- *"I can explain it."*
- *"I will be if I can practice explaining what we're doing."*
- *"It's not much of a problem, but I get nervous."*

October 9th Observations (3:00–4:30 p.m.)

Of the eleven students (4 male, 7 female) participating in *Flexhibit* activities on this date, five are in sixth grade and six are in seventh grade. Five of the students are Caucasian, five are African American, and one is Asian. One of the Asian students who attended the October 4th session was absent today. In addition, a seventh grade African American student joined today, and a seventh grade Caucasian student withdrew due to a time conflict with another obligation. The previously specified site coordinator and three teachers led the observed session.

Research efforts on this date focused on obtaining feedback from participating students about their completion of Activity 2A (*Make a Model Glacier*) and preparation for Activity 2C (*When Ice Meets the Sea*), to be completed the following Thursday (October 11th). The day's schedule was divided into the following six activities:

1. Construct a model ice sheet for Activity 2C (to be completed Oct. 11th)
2. Complete Activity 2A (begun on Oct. 9th)
3. Teacher led questions and discussion
4. View Podcast (*The Larsen B Ice Shelf*)
5. View *Project Iceberg Video Journals* (Season 2006) on DVD
 - Getting to the Rock
 - The Drill Rig
6. Review

The following are findings and recommendations from this site observation:

Activity 2C: When Ice Meets the Sea (3:00–3:10 p.m.)

Following the three-step procedure described in the printed instructions for Activity 2C (Page 78 in the *Activity Guide*), each of the students made a single model ice sheet. Students were not provided with a copy of the *Preview* for this activity (Page 77). The model ice sheet was put into a refrigerator located in an adjacent room to freeze solid for use in the completion of the activity on October 11th.

Activity 2A: Make a Model Glacier (3:10–4:55 p.m.)

In the prior session, students completed the first part of Activity 2A by making model glaciers and placing them in a freezer. Prior to completing this exercise, a session leader reviewed key ideas associated with Activity 2A. When students were asked to describe this task, they did not have difficulty recalling the model making procedure, but they were less clear about the task's intention. There are no goals or purposes stated for the hands-on activities, which may be by design. The absence of a clear take-away message places the burden on the session leaders to frame activities, which they may not do properly since they also have to decipher the intent of the activities, thus possibly resulting in student misconceptions.

The session leader then asked the students to complete the assignment by following the instructions for Activity 2A (Page 66) and construct triangular prisms out of light cardboard to represent linear mountain ranges. The model glaciers would be placed between the parallel mountain ranges to help them imagine and demonstrate how glaciers can grow large enough to form an ice sheet. Once again, students were not provided with a copy of the *Preview* for this activity (Page 65).

Following the four-step procedure, each of the three student groups, with support from a session leader, made triangular prisms by drawing and cutting out trapezoids with dimensions similar to those depicted in the instructions. While the students were interested and engaged in the construction task, they needed considerable help from session leaders, who each remarked that the task is difficult. Students couldn't do the task without the session leaders' help. Drawing the trapezoid was a challenge even for the session leaders.

The leaders wound up drawing the trapezoids, and the students cut them out. Each of the teachers reiterated their prior perceptions by proclaiming: "That's a difficult task." Drawing appropriate angles for the trapezoid was perceived to be the task's greatest challenge. The task can be completed without consideration being given to angles, but this was not readily apparent. There was a consensus of opinion among both teachers and students that using a protractor to reproduce angles that should be indicated in the instructions would be comprehensible and make the task easier. It was also thought that using a protractor would enhance the learning of mathematics. Students at this school reportedly learn how to use a protractor in the 5th and 6th grades.

It took a total of 35 minutes for two groups to each construct two model mountains (i.e., triangular prisms). It took the third group the same amount of time to construct only one model mountain. Two of the model mountains were wrapped in cellophane to protect them from water damage in order to preserve them for the *Flexhibit Event*. While it took a relatively long time to build the models, at the conclusion of this exercise students expressed the following positive sentiments:

- *“The mountains made it look more real.”*
- *“It wouldn’t look like real without the mountains.”*
- *“The mountains helped.”*
- *“Making the mountain was confusing, but I liked it anyway.”*

Upon completion of the construction task, everyone gathered around an empty lab table, and one session leader reviewed what they had accomplished and checked students’ ideas about the layering of pepper and clean ice to represent annual winter and summer snow layers. Four of the model mountains were then put together into two adjacent rows to form a valley between two parallel mountain ranges. The three model glaciers were placed between the mountains to represent solid glacier ice and then covered with paper towels to simulate snow. Looking at the sloping paper towels, which hid the model glaciers from view, some of the students quickly got the idea that the snow would move downhill.

However, after removing the paper towels and picking up the model glaciers, students noticed that the bottoms of the model had melted slightly, leaving water and pepper/sediment. They then revised their thinking to once again conclude that it’s the water and sediment resulting from melted ice beneath the glacier that moves downhill and not the solid ice. This is similar to the results of Activity 2B (*Make a Glacier Flip-Book*) on October 4th and the following sentences contained in Activity 2A’s *Preview*: “Small amounts of liquid water trickle down to the land below the snow. When this liquid water refreezes and expands, rocks from the surface of the land get frozen into the ice at the bottom of the glacier.” A lack of clarity about the intended learning outcomes of the activity and not remaining on track may also have contributed to the confusion, as evidenced by the following exchange during a group discussion at the completion of Activity 2A:

Leader 1: *“Imagine if you had an ice cube laying on a table that was tilted down. When the ice melts, where would the water go?”*

Student: *“Towards the bottom edge of the table.”*

Leader 1: *“That would be towards what you thought was the ice shelf in our simulation. Now imagine we are in Antarctica. Would it remain water?”*

Student: *“No.”*

Leader 1: *“What’s it going to be?”*

Student: *“Ice.”*

Leader 1: *“That’s what this activity was simulating. If it were in our climate, then it would melt and it would just be water. However, down in Antarctica, as the glacier is melting and coming down the mountain it turns to ice and that becomes the ice shelf.”*

Leader 2: *“As we saw at the close of the activity, what does it leave behind?”*

Student: *“A trail of sediment.”*

Leader 1: *“Sediment. You’re right. We need to see the trail of sediment.”*

The students have developed an incomplete understanding about how an ice shelf develops. Mixing ideas about sediment deposition with ideas about glacial movement has led some students to conclude from readings, discussions, and observations of their glacier flip-books and model glaciers that melting is a root cause of glacier movement and ice shelf formation. Others just simply remarked: “I don’t get it.” However, in spite of any difficulties, students were observed to be enthusiastic about demonstrating the activity at the *Flexhibit Event*. They also generated interesting ideas in the follow-up discussion about how this might be accomplished.

Group Discussion (4:55–4:05 p.m.)

The site coordinator discussed the results of Activity 2A with the students and then summarized the key ideas of the activity. The group also discussed ways to present this activity at the *Flexhibit Event* in November. It was suggested that they put the models on a slant board. They also decided to have scheduled show times rather than attempting continually to demonstrate glaciers with ice that will be rapidly melting. Ideas were also offered about how to preserve a supply of model glaciers for use throughout the event. When asked what they thought about Activity 2A, overall, respondents offered the following positive remarks:

- *“That was cool.”*
- *“I liked that.”*
- *“I think it was pretty good.”*
- *“It was fun.”*
- *“It was interesting.”*

As a follow-up question, students were asked to offer suggestions that would make the activity better. The following are their responses to this inquiry:

- *“If you gave us a diagram of the mountain so we could cut it out without having to draw it.”*
- *“It took a long time to make the mountains.”*
- *“If the instructions gave the angles in the drawing and we had a protractor it would have helped.”*
- *“It was okay, but if you could actually see the glacier move rather than covering it with paper towels would have been better.”*

- *“Put the glaciers and mountains on a slanted board and cover them with cellophane rather than paper towels so we could actually see our glaciers move.”*
- *“It would be a lot more fun for me to watch a glacier come down a mountain and leave a trail rather than watch it sit underneath paper towels.”*
- *“Put the ice on top of the cellophane so it will be less messy.”*

View Podcast and Video Journals (4:05–4:25 p.m.)

The students moved to the desks to view a Podcast of the *“The Larsen B Ice Shelf”* via a computer projector and retractable movie screen. The female science teacher and site coordinator guided a follow-up discussion. They discussed how much of the United States would be covered with water if Antarctica’s ice melted. At the request of the male social studies, they also reexamined the thickness of the ice depicted in a Podcast picture. Everyone was quiet, attentive, and responsive to questions and discussion.

Students then viewed the two *“Project Iceberg Video Journals”* (Season 2006) contained on a DVD: *Getting to the Rock*; *The Drill Rig*. Again, everyone was quite and attentive.

Review (4:25–4:30 p.m.)

The site coordinator reviewed the main issues/ideas and outcomes related to the day’s activities.

Session Leaders’ Feedback

In a follow-up discussion, session leaders offered the following additional feedback:

- *“There needs to be a Teacher’s Guide in addition to the current Activity Guide. The Activity Guide is not a standalone resource.”*
- *“Each of the Units in the Activity Guide require materials that are not listed at the beginning of Pages 5 and 6 in the Materials List. An attempt was made to obtain all of the necessary materials at one time, but someone has to frequently take time to secure additional materials.”*
- *“The activities are appropriate for 6th and 7th graders, so far, but too advanced for 3rd, 4th, and 5th, graders.”*
- *“The students have said that the banners are comprehensible.”*
- *“The students are telling the Administrative Assistant in the school’s main office (“which is outside of the leaders’ ears”) that they are enjoying the sessions.”*
- *“We need to receive project resources (Activity Guides, banners, etc.) well before sessions begin so they can be reviewed and used for preparation.”*
- *“Sessions should be divided among the leaders rather than having all of them attend every session.”*

- *“The students are not grasping the point of Activity 2A when the model glaciers are covered by paper. Maybe it would help if we made a larger model glacier and then placed it on top of cellophane and a slant board.”*
- *“If Activity 2A was done right, they would develop math skills from it, but as it is it’s too frustrating for the students. A protractor would have helped. They need to include angles in the instructions.”*