STeLLA PD Program Norms for Working Together

The Basics

1. Arrive prepared and on time; stay for the duration.

2. Remain attentive, thoughtful, and respectful; eliminate interruptions.

3. Make room for participation from all and monitor your talk time).

The Heart

4. Keep the goal in mind: We are analyzing teaching to improve student learning.

5. Share your ideas, uncertainties, confusions, disagreements, and questions

6. Expect and ask questions to deepen everyone's learning!

BSCS SCIENCE LEARNING

Teacher/Video	SSUP_SEC_GR 5_ACharles_L1_C1
Content Area	Sun's Effect on Climate
STeLLA Strategy	Strategy 4: Engage students in communicating in scientific ways
Context	This clip is from lesson 1 of 6 from the Sun's Effect on Climate unit. The teacher introduces the CSW chart and identifies which stems students could focus on for their discussions.

00:00:03	Teacher:	It's gonna take us the whole unit to get to this central question, but for today, and for the next couple of days in lesson 1, we're gonna be focusing on: What patterns in temperature can you find on Earth at different times of the year? Do you see how that's kind of broken up the big question into a smaller one? So what patterns in temperature can you find on earth at different times of the year? That's what I want you thinking about as we do this lesson, and if you'll take a look over here behind Emma, I have that focus question posted. Take a look over here behind Emma, guys. So at any point, if you're not sure of what our focus is, you can take a look over here. What patterns in temperature can you find on Earth at different times of the year? So, we're gonna start by looking at the patterns in temperature, but I want us to use our communicating in scientific ways as we do this. You have that in your red folder, if you need to reference it. The big chart is also hanging here, but it's probably easier to see in your folder, so if you wanna open your folder so-so you can kinda look at that. Today I want us to use just these four sentence starters. Okay? The-- Oh, I don't know if that shows up on there. No, doesn't. Okay. To observe, okay, I see, I noticed, I measured. We'll use that. Number three, organize data and observations and look for patterns. Okay, and that would be, I see a pattern. I think we can make a graph. I see a relationship between those sentence starters. We'll also look at number six, uh, Listen to others' ideas and ask clarifying questions. And number seven, which is, Agree or disagree with others' ideas and add on to someone else's ideas. So, think about this, which ones of those are easy for you? Are there some that are easier than others?
00:02:15	Speaker 1:	Yeah.
00:02:16	Teacher:	There are some I've already heard you use, so that would probably easier. Which ones are easier? Donovan, your hand one up fast. Which ones are easier to use?
00:02:24	Donovan:	Um, observing
00:02:26	Teacher:	Observe? Yeah, I see. I notice we're really good at those already, right? Jeremiah, which ones are easier for you?
00:02:33	Jeremiah:	I agree/disagree with (crosstalk.)
00:02:36	Teacher:	The, I agree or disagree, because, yes-- and th-that also has to add on to somebody's, and you guys, lots of people did that already, right? Which ones are

harder for us, you think? Which ones seem to be harder for us to do? Which ones are harder? Yeah, Megan.

00:02:56 Megan: The, Make observations and organize or-- and organize data.

00:03:03 Teacher: So organizing the data. And we really haven't had much chance to do that, but we're gonna get into that one. Jeremiah, do you wanna have another that's harder?

00:03:10 Jeremiah: Yes. I see a pattern, I think unintelligible 00:03:11.

00:03:17 Teacher: So the-- you said the I see a pattern?

00:03:19 Jeremiah: Yes.

00:03:19 Teacher: Yes. So we're gonna have a chance today to do that.

Teacher/Video	SSUP_SEC_GR 5_ACharles_L1_C2
Content Area	Sun’s Effect on Climate
STeLLA Strategy	Strategy 4: Engage students in communicating in scientific ways
Context	This clip is from lesson 1 of 6 from the Sun's Effect on Climate unit. Students are called to the board to state and show their noticings and wonderings.

00:00:03	Teacher:	All right. I want you to listen carefully to what Bentley's gonna say to us. Bentley, what did you notice?
00:00:09	Bentley:	Uh, that from south, it's hotter. And then as it goes north, it becomes colder.
00:00:15	Teacher:	Okay. Come show us up here. Which map do you wanna see first? The other one?
00:00:18	Bentley:	This one.
00:00:20	Teacher:	This-this one. Okay. Take a look- take a look at what Bentley's gonna share with you.
00:00:26	Bentley:	As it's at south, it's hotterer by the temperature bar there, and it-- As it goes north, it becomes colder on each map.
00:00:36	Teacher:	Okay. So show us on the other map too.
00:00:39	Bentley:	This one is hotter, as it goes up, it becomes colder.
00:00:42	Teacher:	So he noticed a pattern. You notice his pattern? In the south, right? It's warmer. And as it goes north, the temperature gets cooler. Anybody else see that pattern too? Yeah, I agree. All right, Megan,
00:00:58	Megan:	I noticed that one part on the map is only goes up 10 degrees.
00:01:04	Teacher:	Okay. Come show us. Come show us. Look at what she's-- and you might wanna circle this and notice it too.
00:01:10	Megan:	On this part of the map, right now, it is 50 to 60 degrees. And then on the other map-
00:01:20	Teacher:	Which I went the wrong way. Okay. There you go.
00:01:21	Megan:	-it is only 10 degrees here.
00:01:25	Teacher:	What can we say about that? She noticed the pattern that-- Did the temperatures change much in that area?

00:01:31 Megan: No.

00:01:32 Teacher: Mm. Okay. What else do we notice? Ansley?

00:01:38 Ansley: Um, can I show up there?

00:01:41 Teacher: Yes. Come show us.

00:01:43 Ansley: unintelligible 00:01:43 to the other paper.

00:01:44 Teacher: Okay.

00:01:46 Ansley: Um.

00:01:47 Teacher: There you go.

00:01:48 Ansley: So I noticed that like right here and here--

00:01:56 Teacher: Do you see where she's pointing at?

00:02:00 Ansley: Um, they have different-- like on this, on the blue paper—can you go back to the blue paper?

00:02:03 Teacher: I sure can go back to the blue paper. Yes.

00:02:05 Ansley: I noticed-- it got unintelligible 00:02:06 lower, but actually lower.

00:02:08 Teacher: So in that first picture, did you hear what she said? The temperature tallying got a little lower, but not much lower between the maps.

00:02:15 Ansley: But on this one.

00:02:16 Teacher: I can, yes, except for, I always go the wrong way. Okay.

00:02:20 Ansley: Um, sorry. Like these are in the 50s, 60s to the 40s to 60s. And on the other map, um--

00:02:29 Teacher: Mm, I know, I'm terrible at the pointer.

00:02:33 Ansley: It changed, it got real lower and not much higher.

00:02:37 Teacher: So take a look at yours 'cause you can see the numbers better. Do you see what Ansley's saying? Okay. In this first section and do you know what this is on the map? What is this little area down here?

00:02:47 Ansley: Hawaii.

00:02:47 Teacher: Hawaii. The temperatures didn't change much in Hawaii from one map to the other, is what she noticed.

00:02:52 Ansley: And this one, like--

Daily Reflections – Day 1 Name: ____________________________

1. What are your first reactions to the claim that it is important to plan and analyze science teaching through the Student Thinking and Science Content Storyline Lenses?

2. This week we will be focusing on the Sun's effect on climate and seasons. What struggles have you encountered teaching the Sun's effect on climate and seasons? What seems to get in the way of students developing a firm grasp of the concepts around patterns in average temperature on Earth and the factors that cause the seasons?

3. Provide feedback about today's session and the program so far (likes, dislikes, questions, concerns, suggestions).

TIMSS Science Public Release Lesson USA 3 clip 1 (clip id: TSCP001-5-001-C3)

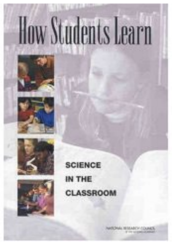
Timecode	Speaker	Dialogue/Logging
00:00:03.00	T	Okay. Everyone should have the "Pulley Potpourri" sheet out in front of you;
00:00:06.00	T	the lab sheet.
00:00:08.00	SN	Who thought of that name?
00:00:10.00	T	I did. It's my lab.
00:00:38.00	T	Shh. We're gonna get started on the lab today.
00:00:45.00	T	Shh. Folks, I need your attention up here, please.
00:00:50.00	T	I'm glad you guys are having so much fun coloring inside the letters,
00:00:53.00	T	but (if) I could get your attention up here, I would really appreciate it.
00:01:01.00	T	We went over this yesterday. I'm just gonna recap it today because it's been 24 hours,
00:01:04.00	T	and I know you forgot.
00:01:10.00	T	You're just gathering three pieces of data from each pulley setup.
00:01:15.00	T	You're gathering the effort distance, the effort force and the resistance force.
00:01:22.00	T	As I went over yesterday, you measure the resistance force just by picking the weight up with the scale,
00:01:32.00	T	and you measure the effort distance by using the ruler in centimeters to measure
00:01:35.00	T	how far you pull when you lift the weight by 10 centimeters.
00:01:45.00	T	The resistance distance in every case is 10 centimeters.
00:01:50.00	T	If I can have your attention back here-
00:01:55.00	T	just quickly go over this for the first setup again.

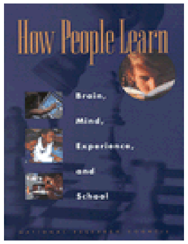
00:01:58.00	T	There are two rulers back at the station.
00:02:06.00	T	You'll be using both of them at the same time.
00:02:09.00	T	One person is gonna be measuring resistance distance; one person is gonna be measuring
00:02:13.00	T	effort distance.
00:02:15.00	T	So you'll have one person using the centimeter side of the ruler.
00:02:18.00	T	There's an inches side.
00:02:22.00	T	Don't use the inches; use the centimeters.
00:02:24.00	T	They're gonna be measuring how high the bottom of the weight goes up.
00:02:29.00	T	When it's at 10 centimeters, that's as far as you're going.
00:02:33.00	T	While they're doing that, the person applying the effort to the simple machine,
00:02:35.00	T	the person pulling on the string,
00:02:42.00	T	is gonna be measuring how far they have moved the string to raise the weight ten
00:02:45.00	T	centimeters.

TIMSS Science Public Release Lesson Japan 1 Clip 1 (clip id: TSCP001-3-001-C1)

Timecode	Speaker	Dialogue/Logging
00:00:02.23	T	Uh, when you exposed water to electricity... Daijiro-kun.
00:00:09.25	SN	Oxygen and hydrogen.
00:00:11.04	T	Yes, it separates into to two separate substances of oxygen and hydrogen. Okay, that's the conclusion, right?
00:00:25.24	B	Water --> Hydrogen + Oxygen
00:00:45.17	T	Since you expose it to electricity, you call this type of separation... uh, Chihiro-san. What kind of separation is this called?
00:00:57.19	SN	Electrolysis.
00:00:58.11	T	Yes, electrolysis.
00:01:04.21	B	Electrolysis
00:01:15.15	T	Okay, electrolysis.
00:01:17.23	T	And this is what we did yesterday. So today, what we'll be thinking is water. Being exposed to electricity, it can be separated into hydrogen and oxygen. So what happens in the opposite?
00:01:40.06	T	What I mean is if we have hydrogen and oxygen, is it possible to make water?
00:01:48.22	T	If it was this way. How would it be if the arrow was pointing this way?
00:01:54.09	T	This is what I would like to consider today.
00:02:00.14	T	Okay then, now discuss with your neighbors to see if you think you can make water from hydrogen and oxygen. If you suppose that you can then talk about how you could do it.
00:02:16.06	T	So discuss in depth and think about it please.
00:02:19.14	T	If you suppose that you can't do it, then talk about why you can't do it.

Synthesis of Research from
How People Learn: Brain, Mind, Experience, and the Classroom
How Students Learn: Science in the Classroom





Adapted by BSCS from:

National Research Council. (2000). *How People Learn: Brain, Mind, Experience, and School*, Washington, DC: National Academies Press. Available for free download at www.nap.edu

National Research Council. (2005). *How Students Learn: Science in the Classroom*, Washington, DC: National Academies Press. Available for free download at www.nap.edu

KEY FINDINGS ABOUT HOW STUDENTS LEARN SCIENCE

1. Students' prior knowledge must be engaged.

A fundamental insight about learning is that *new understandings are constructed on a foundation of existing understandings and experiences*. Students come to the classroom with preconceptions about how the world works. The understandings they carry with them into the classroom will shape significantly how they make sense of what they are taught (see "A Fish Story" and imagine your students as the fish and the frog as you, the teacher). If students' initial knowledge is not engaged, the students might fail to grasp the new concepts and information that are taught; they might distort the new information to make it fit with their prior experience (as the fish did), or they might memorize facts for purposes of a test but revert to their preconceptions outside the classroom. NOTE: It is not just inattentive students who misinterpret science instruction; students who are trying hard to make sense of the science ideas will want to make the new science ideas fit with their own experience which can lead to misinterpretations of the science ideas.

With respect to science, everyday experiences often reinforce the very conceptions that scientists have shown to be limited or false, and everyday modes of reasoning are often contrary to scientific reasoning. Research shows that many high school and college students still hold the same misconceptions as young students, despite having studied the scientific explanations in high school and college. Students also have misconceptions about how scientists think and work, often failing to appreciate the centrality of conceptual knowledge in the scientific inquiry process.

Implications for Teaching

Draw out and work with the preexisting understandings that students bring with them.

- Abandon the model of the student as an empty vessel to be filled with knowledge and instead think of students' heads as filled with a myriad of wonderful ideas and experiences relevant to the science you are teaching. Actively inquire into students' thinking, creating classroom tasks that will reveal student thinking. Then plan ways to help students find the scientific conceptions useful and meaningful so they can change their initial conceptions to accommodate the new ideas. Students need opportunities to explore their own ideas, to appreciate the limitations of their ideas, to understand how scientific explanations are different from their own, to make sense of scientific explanations, and to use this learning process to change their everyday conceptions to ones that are more scientifically accurate and that make sense to the learner.
- The use of frequent formative assessment helps make student thinking visible to themselves, their peers, and their teacher. Given the goal of learning with understanding, assessments of all types must tap students' understanding and develop their ability to use and apply knowledge rather than merely repeating facts or performing isolated skills.

KEY FINDINGS ABOUT HOW STUDENTS LEARN SCIENCE

2. Organizing science knowledge into conceptual frameworks is essential in developing scientific understanding.

To develop understandings that truly change the way students think about the world around them, students need a deep foundation of usable knowledge that is organized in their minds as a connected, conceptual framework that they know how to use to make predictions, solve problems, explain new situations, and so forth. This kind of deep understanding contrasts with the kind of learning so commonly tested in science classrooms – memorization of lists of science terms and facts. This idea of learning with understanding has two parts: (1) To be meaningful beyond passing a test, factual knowledge MUST be placed in a conceptual framework (a set of connected "big ideas"), and (2) Concepts are given meaning through experiences with multiple representations that are rich in science ideas and details and through experiences with multiple phenomena that the ideas help explain. The scientific concepts take on meaning as students see their usefulness in explaining a variety of real-world situations and phenomena.

Students can be supported in building conceptual understandings by actively engaging in processes of scientific inquiry. Opportunities to learn science as a process of inquiry involve drawing from first-hand data and observations and using knowledge of the data and science ideas to reason about the phenomena under study. This process can be used to challenge and build on students' initial ideas and everyday experiences of the world. It can also provide evidence to help students see a need for different explanations and why scientific explanations make sense.

Implications for Teaching

Teach science in depth, providing many examples in which the same concept is at work and providing a firm foundation of knowledge of science ideas.

- Superficial coverage of all topics in science should be replaced with in-depth study of fewer topics that allows key science concepts to be understood.
- Teachers need in-depth knowledge of the science content they will teach, the nature of scientific inquiry and the terms of scientific discourse, and the relationship between science concepts and real-world phenomena.
- Assessments for purposes of accountability (e.g., statewide assessments) must test deep understanding rather than surface knowledge. A teacher is put in a bind if she or he is asked to teach for deep conceptual understanding, but in doing so produces students who perform poorly on standardized tests. Much work needs to be done to minimize the trade-off between assessing depth and assessing objectively (e.g., multiple choice tests).

KEY FINDINGS ABOUT HOW STUDENTS LEARN SCIENCE

3. Learning to monitor one's own thinking is essential in learning to think like a scientist.

A "metacognitive" approach ("thinking about thinking") to instruction can help students learn to take control of their own learning by engaging them in understanding learning goals and monitoring their progress in achieving them. A metacognitive, or self-monitoring, approach can help students develop the ability to reflect on their own thinking and learning processes.

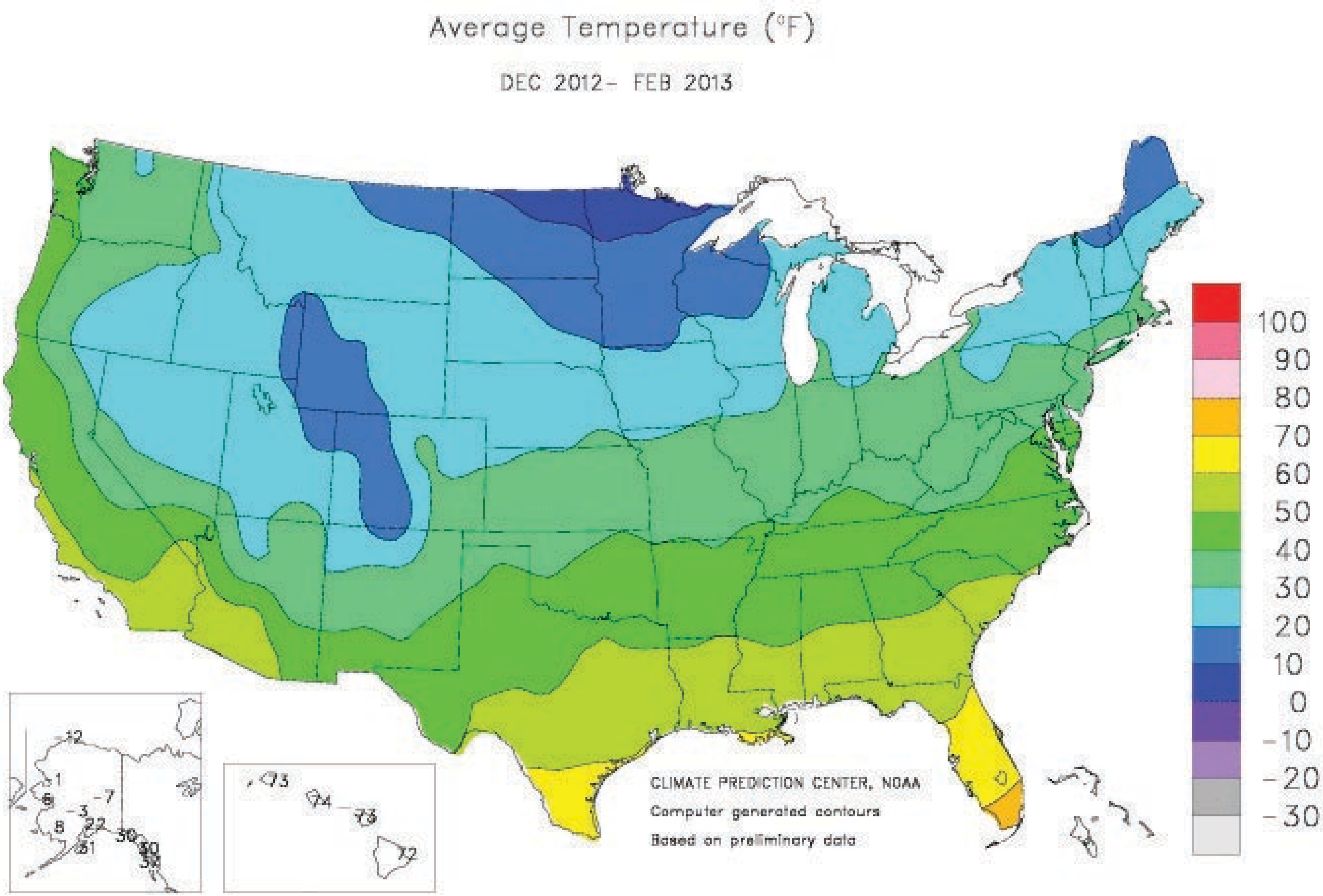
In science, we can help students think like scientists by using metacognitive approaches that make scientific thinking processes visible and engage students in reflecting on how their own thinking is similar to and different from scientific ways of thinking. For example, students can examine the tendency of us all to attempt to confirm rather than rigorously test (and possibly refute) our current ideas. The approach is deepened when you help students learn why and how to create models of phenomena that can be put to an empirical test. Through metacognition, students reflect on their role in inquiry and on the monitoring and critiquing of their own claims, as well as those of others. Applying a metacognitive habit of mind helps students compare their personal ways of knowing with those developed through centuries of scientific inquiry. Being metacognitive about science is different from simply asking whether we comprehend what we read or hear; it requires taking up the particular critical lens through which scientists view the world.

Implications for Teaching

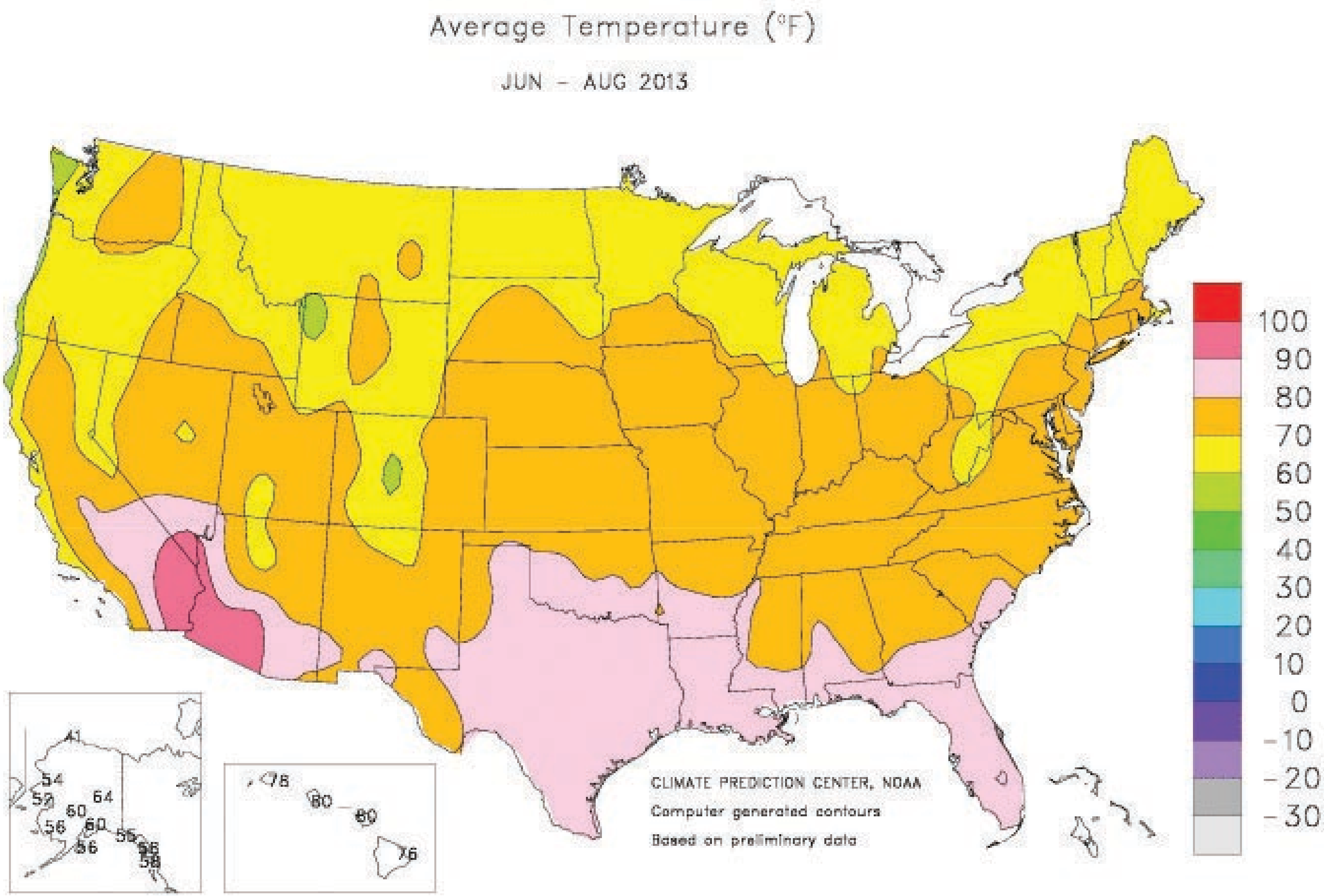
The teaching of metacognitive thinking should be integrated into the science curriculum.

- Help students understand the discourse that scientists use as they make sense of their data and observations – both their internal dialogue and external communication with a community of scientists. It is not enough to give students tasks that require them to think and reason. In addition, students need to learn how scientists think and reason and how that might contrast with their own ways of thinking and making sense. For example, students should learn to ask questions such as: *How do we know that? What's your evidence?*
- To help students monitor their developing understandings, engage them in reflecting on their learning, their changing ideas, and their remaining questions and wonderings. A lesson summarizing activity, for example, might prompt students to reflect on how their ideas have changed and why. Alternatively, the class might pause after a science discussion to reflect on ways they did and did not think and communicate in scientific ways during the discussion.

Map of US with Average Temperatures, Dec–Feb



Map of US with Average Temperatures, Jun–Aug

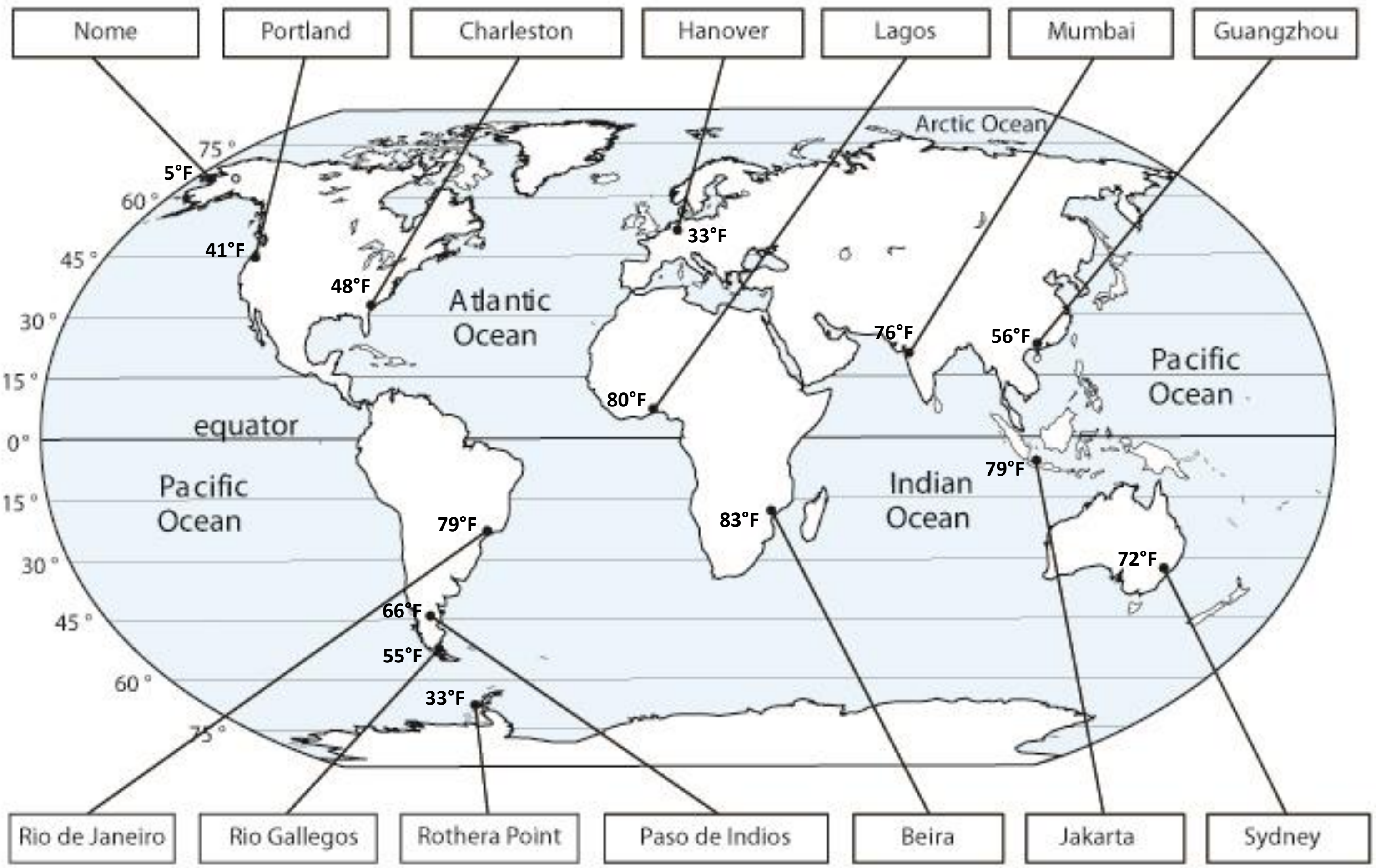


Average Temperatures around the World
January and July

Average Temperatures around the World January and July			
City and country	**Latitude**	**January temperature**	**July temperature**
Lagos, Nigeria	6°N	80°F	77°F
Jakarta, Indonesia	6°S	79°F	80°F
Mumbai, India	19°N	76°F	82°F
Beira, Mozambique	20°S	83°F	70°F
Guangzhou, China	23°N	56°F	83°F
Rio de Janeiro, Brazil	23°S	79°F	69°F
Charleston, SC, USA	33°N	48°F	80°F
Sydney, Australia	34°S	72°F	53°F
Portland, OR, USA	45°N	41°F	69°F
Paso de Indios, Argentina	45°S	66°F	39°F
Hanover, Germany	52°N	33°F	62°F
Rio Gallegos, Argentina	52°S	55°F	33°F
Nome, Alaska, USA	65°N	5°F	52°F
Rothera Point, Antarctica	67°S	33°F	11°F

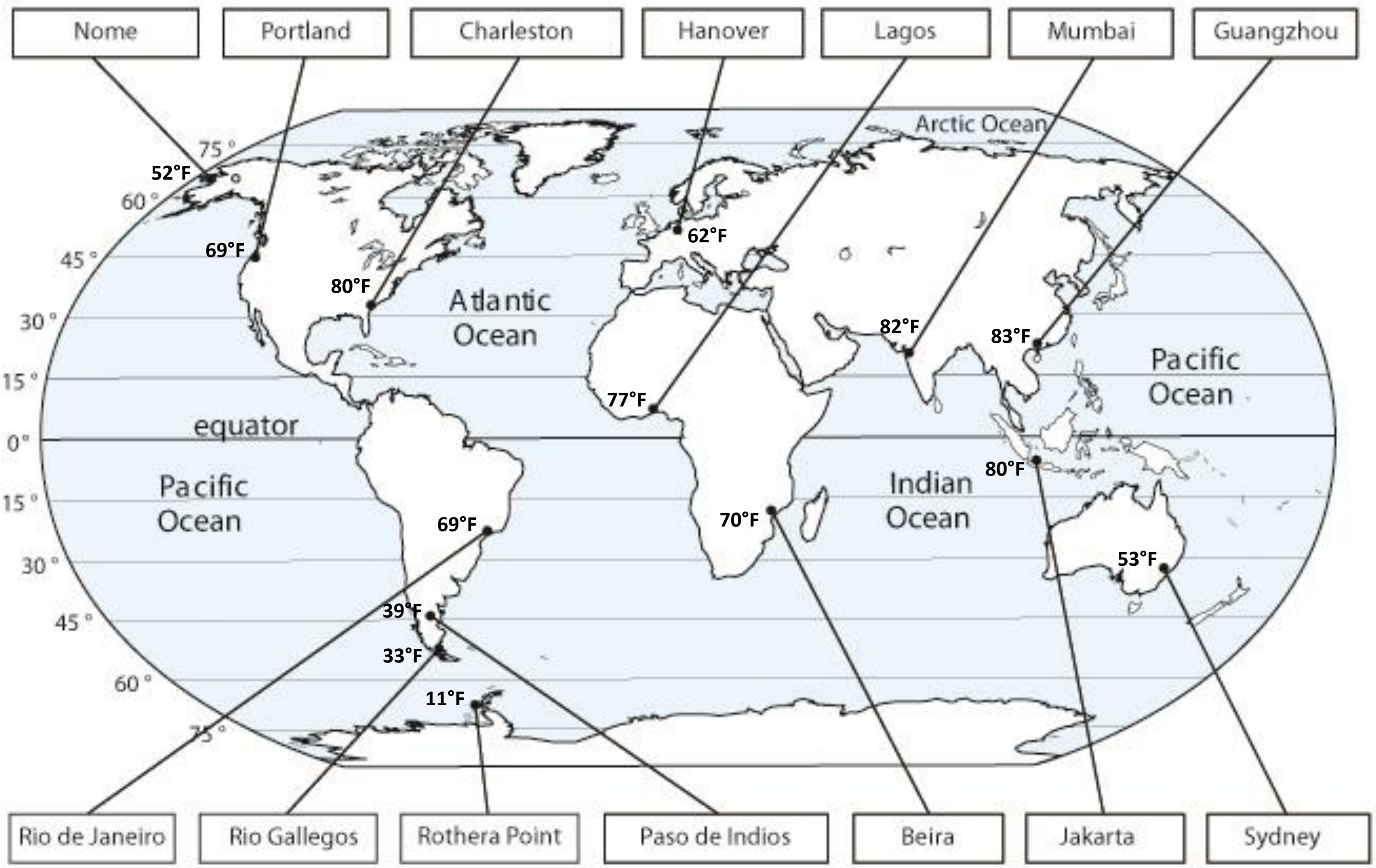
World Map Record Page

Temperatures during **January**

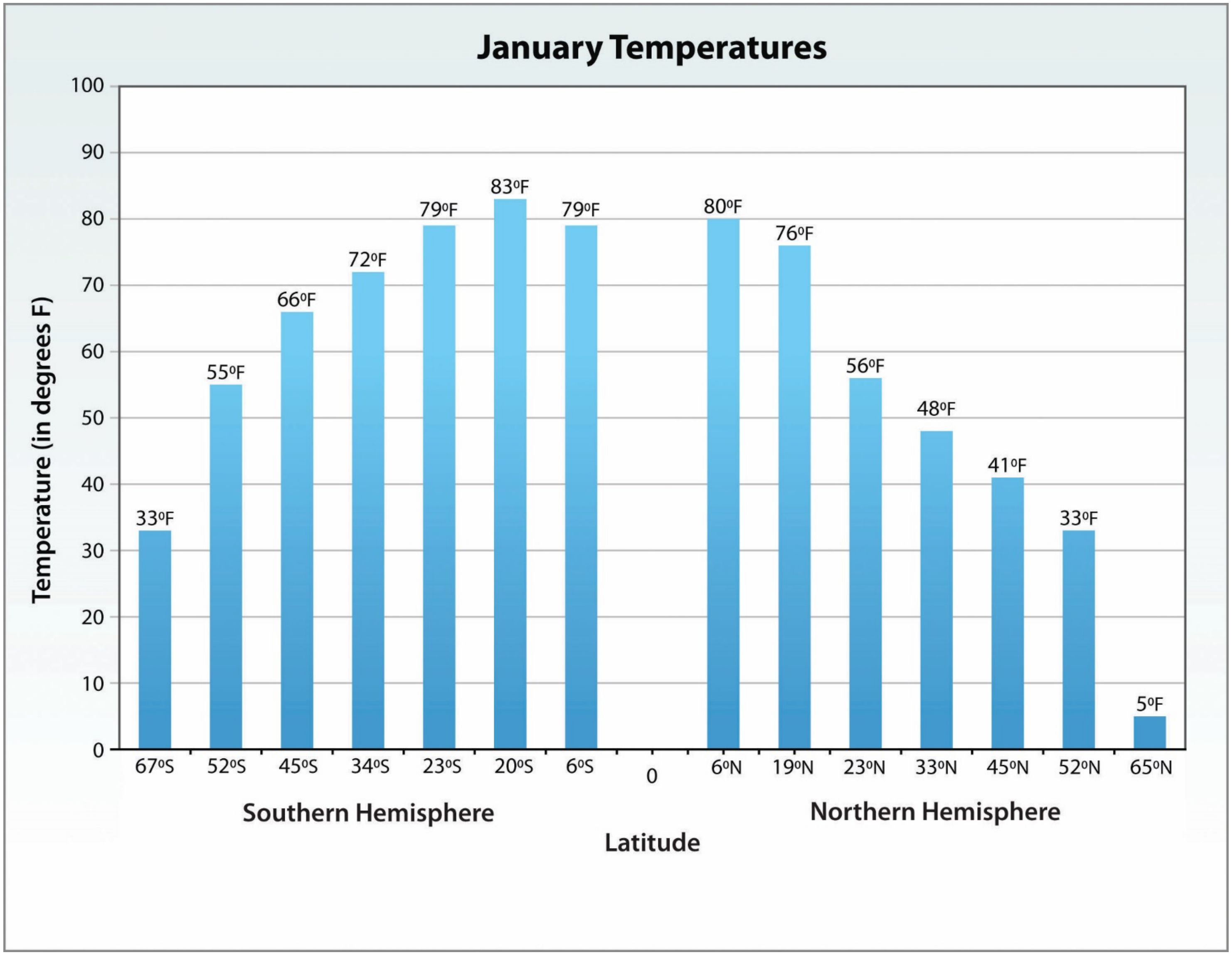


World Map Record Page

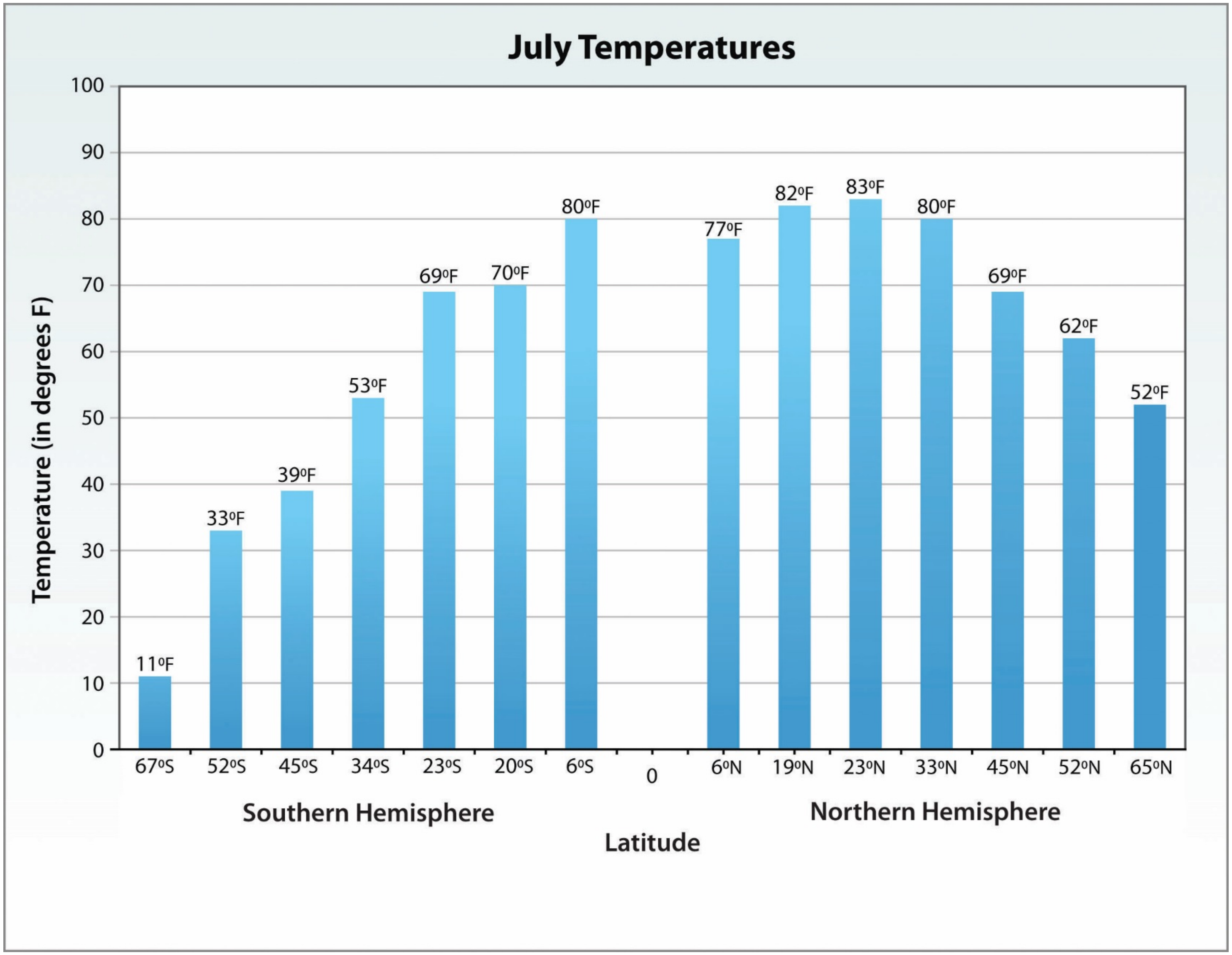
Temperatures during July



Bar Graph of January Temperatures



Bar Graph of July Temperatures



World Map Record Page

Temperatures during ____________________