Teacher/Video	STeLLA2-03-hannigan6-pre-illian C1
Content Area	Sun's Effect on Climate and Seasons
STeLLA Strategy	Strategy 1: Ask questions to elicit student ideas and predictions Strategy 2: Ask questions to probe student ideas and predictions Strategy 3: Ask questions to challenge student thinking
Context	In this pre-interview, a student describes his understanding of why they thinks different latitudes on Earth experience different temperatures.

KEY: **I**: Interviewer
S: Student

00:00 I So what about in July? What do you think the temperatures would be like in those three places?

00:08 S Um, it- From Argentina it kind- Um, I think it would be Argentina, more 40s and 50s. Up here the same. And up here 70s and 80s.

00:23 I Okay. And why did you say Argentina would be-? What did you say? 40s and 50s?

00:27 S Yeah.

00:29 I Uh-huh. Why did you say that?

00:31 S Um, 'cause it's a different time of year and, um, the sun is hitting it at a different way so you're not getting as much sun.

00:40 S So it would be a little colder. But, um, Argentina doesn't get that cold like we do.

00:48 I Okay. Okay. So, um, I'm gonna turn the sun back on. And I'd like you to explain to me, or show me with the, the sun and the globe.

01:04 I So what you're saying is that up here in Colorado in the summer it's gonna be warmer than in Argentina.

01:12 S Mm-hmm.

01:14 I Okay. So can you show me with, with the sun and the globe why that is?

01:20 I Or, or, if you would rather, you can draw a picture.

01:24 S Um, I can…guess I can show you.

01:27 I Okay.

01:28 S I think the earth is still at the same tilt and it's just moving, um, it's spinning each day and it's moving around, um, the sun.

01:40 S And, um, so it's spinning and moving this way, much slower though. And, um, as it spins the tilt is, um, it's still chan…it's the same way.

01:57 S And so because it's the same way it's diff…um, the sun is hitting it at different spots.

02:05 I Uh-huh. And when you say it's tilting the same way, what do you mean?

02:08 S It's always tilted like back. And so as it tilts back and spinning, um, we get different, um, sun.

02:20 I Okay. So, so show me. Go all the way around. You don't have to worry about the spinning.

02:24 I But go all the way around and show you what you mean by it's always titled back.

02:29 S It's always titled about this much and then just going around like this.

02:36 I Okay.

02:37 S So tilted about that much.

02:38 I Okay. So let's, um- Let's show Colorado Springs.

02:43 I And I want you to go around again. And I want you to, to show me when it's winter in Colorado Springs. If you can.

02:53 S Um, I'm not really sure but I think, um- So if this is like when we get the new year, winter is this around here.

3:11 S And then this is- So over here is, um, would be summer. Um, I don't really know how to explain it.

3:21 I Okay. So when it's here you think it's probably winter.

3:28 S Yeah.

3:29 I And when it's here you think it's summer?

3:33 S Yeah, I don't really know why. I'm just-

3:35 S Like if the new year is here just because the year is winter, um, then it would have to be somewhere over here.

3:42 I Uh-huh.

3:43 S But-

3:44 I But it doesn't seem like you're totally-

3:46 S I don't really know why.

3:48 I Uh-huh. You don't know why that would be.

3:50 S Yeah.

3:51 I Does it make sense to you?

3:52 S Um-

3:53 I Like if you- Like if this is winter…

3:58 S Mm-hmm.

4:00 I …and this is summer, does that make some sense to you?

4:04 S Um, I don't- It doesn't really make sense why it would be colder and, um, warmer. But it makes sense how it spins and, um, the time of year.

4:16 I And, okay, just say a little bit more about that, what…that part, the part that makes sense.

4:23 S The part-

4:24 S So when, um, since it takes a whole year to get all the way around the sun it makes sense that-

4:34 S So if this is New Year's Day then this would be halfway, um, through the earth.

4:41 I Yeah. Okay. So it makes sense that it would take like half the year to get…

4:45 S Yeah.

4:46 I …over there. And that that would be a different season.

4:48 S Yeah.

4:49 I And the part that doesn't make sense is the, the warm-cold?

4:52 S Yeah.

4:53 I Okay. I gotcha. That's fine. Maybe you'll figure something out before I talk to you on Friday.

5:02 I Um, but you clearly have this idea that, um, that it goes around the sun.

Teacher/Video	SSUP_SEC_GR 5_DWade_L1_C1
Content Area	Sun's Effect on Climate and Seasons
STeLLA Strategy	Strategy 1: Ask questions to elicit student ideas and predictions Strategy 2: Ask questions to probe student ideas and predictions Strategy 3: Ask questions to challenge student thinking
Context	This clip is from Lesson 1 of 6 of a unit titled, Sun's Effect on Climate and Seasons. The focus question for the lesson is: What patterns in temperature can you find on Earth at different times of the year? Students have just looked at a data table and transferred temperature data from the table onto a world map. During this clip they are sharing patterns they noticed in the data.

00:00:00	Teacher:	So think about our question. What patterns in temperature can you find on earth? Not just in the United States, what patterns in temperature can you find on earth at different times of the year? Okay. Chloe
00:00:28	Chloe:	Uh, Australia, inaudible 00:00:29 Alaska in July inaudible 00:00:37
00:00:36	Teacher:	Okay. So what's your pattern? What is a pattern that you're noticing on earth?
00:00:54	Chloe:	Um, it's hotter up-up north and then it's colder in January.
00:01:01	Teacher:	In January or-
00:01:04	Chloe:	In July.
00:01:06	Teacher:	In July? So when you say it's hotter up north. Guys, will you find the equator on your maps. Look at your maps. And that line that goes all the way across right in the middle is called the equator. And this is gonna be a good point of reference for us. Okay. And so Chloe, you said it's hotter in the north, in July than in the south. Can you talk a little more about that?
00:01:40	Chloe:	Like if you go down inaudible 00:01:49 and like it is really inaudible 00:01:54 like a lot inaudible 00:01:56
00:01:56	Teacher:	Okay.
00:01:56	Chloe:	And like when you go down south, it's a lot more like the 60's inaudible 00:02:02
00:02:03	Teacher:	Okay.
00:02:04	Chloe:	-and, uh, inaudible 00:02:05
00:02:06	Teacher:	So when you say down south, are you meaning below the equator? So are you saying, Chloe, that in July it's warmer on the top half or the northern hemisphere and cooler in the southern hemisphere in July? Right. Does anybody disagree with

Chloe's statement? Shay, do you disagree with Chloe's statement?

00:02:33 Shay: No, but I would like the piggy bank- back

00:02:35 Teacher: Okay. Great way to add on and talk like a scientist.

00:02:39 Shay: So what-what Chloe said I think was right, but, um, I would like to piggy-- I would like to add on. So whenever you go under the equator-equator in January, it looks like they're experiencing different seasons.

00:02:54 Teacher: Ooh, interesting. So when you say it looks like they're experiencing different seasons, what do you mean exactly?

00:03:01 Shay: So whenever you go to like the United States or China or something like that, it gets colder-

00:03:08 Teacher: In January?

00:03:10 Shay: In January. But whenever you go like down to Antarctica or Brazil, it gets warmer. So they must be like in summer while we are in winter.

00:03:18 Teacher: Okay. So Shay is noticing different seasons occurring at the same time of the year. While we're having winter, they're experiencing summer. Anybody else? I forgot your name. Tell your name.

00:03:32 Holden: Holden.

00:03:33 Teacher: Holden.

00:03:34 Holden: Um, it looks like it's getting-- it's hotter on, the- the south of the equator. South.

00:03:43 Teacher: In January? Okay. It's warmer south of the equator in January. All right. Anybody else have a pattern they wanna share?

Practice Probe/Challenge Protocol

Practice Probe Questions

The Task:
Practice using probe questions by posing an elicit question to a partner and then ask **ONLY** probe questions to find out what your partner thinks.

To prepare:

- Read your elicit question.
- Think about what ideas may be shared in your partner's responses.
- Plan probe questions.

Practice:

- Round 1
- Round 2

Group discussion about the interviews

- How did the interviews go? What was difficult? As an interviewer? As a responder?
- What probe questions revealed interesting ideas?
- Were any of your questions challenge questions?

Practice Challenge Questions

The Task:
Practice using challenge questions by posing an elicit question to a partner, asking probe questions, and then ask at least one challenge question to find out what your partner thinks.

To prepare:

- Read your elicit question.
- Think about what ideas may be shared in your partner's responses.
- Plan probe and challenge questions.

Practice:

- Round 1
- Round 2

Group discussion about the interview

- How did the interviews go? What was difficult? As an interviewer? As a responder?
- What probe and challenge questions revealed interesting ideas?
- What role does content knowledge play in a teachers' ability to ask productive probe and challenge questions?

Daily Reflections – Day 2 Name: _____

1. We are discussing elicit, probe and challenge questions to reveal student thinking. How do these types of questions resonate with your current questioning style? What role do you think the use of these questions play in revealing student thinking? Explain your thinking.

2. What challenges do you anticipate or have you encountered when trying to develop a classroom culture that values student thinking? How do you see the STeLLA strategies contributing to a culture that values student thinking?

3. Does the tilt of the Earth effect differential heating of Earth's surface? If so, how? If not, why not?

Science Content Handouts

Energy Angles Investigation

Purpose

This activity will help us answer our unit central question:

- Why are some places on Earth hotter than others at different times of the year?

Team Task

Investigate the scientific question:

- What causes the average temperatures on Earth near the equator to be higher than the average temperatures on Earth far from the equator?

During the investigation, describe what happens to light when it shines on graph paper at different angles. Be prepared to share your ideas.

Materials

Your materials:

1 tray	1 pair of scissors
2 pieces of graph paper	Tape
Flashlight	Pencil
1 ruler	Your science notebooks

Directions Part I

1. Tape one piece of graph paper to the tray.
2. Decide who will hold the flashlight and who will hold the tray.
3. To describe what happens to light that shines at different angles onto a surface, do these things:
    a. Turn on the flashlight. Stand about one foot from your partner who is holding the tray. (Use your ruler to check the distance.)
    b. Point the flashlight directly toward the graph paper. Hold the tray straight up and down, directly in front of the flashlight.

c. Observe the shape and size of the light image and describe it to your partner.

d. Trace around the pattern of light. (The person holding the tray should trace the pattern without moving the position of the tray. Take your time!)

e. Cut out the image and label it “straight on.” (Write the label on the back of the image.)

f. Next, tape a new piece of graph paper to the tray.

g. Then, tip the tray **down** so the light shines on the graph paper at an angle or a slant. Remember to hold the flashlight about one foot from the tray at all times. (Use your ruler to check the distance.)

h. Observe the shape and size of the light image and describe it to your partner.

i. Trace the new pattern of the light. (Remember to take your time to be as accurate as possible.)

j. Cut out this image and label it “at an angle.” (Write the label on the back of the image.)

k. Now, tip the tray at different angles and observe what happens to the light. (You do not need to record these images. Just notice what happens to the light when you have less of a slant—less of an angle—and more of a slant—a greater angle.)

4. Talk about these questions with your partner.

   a. How does the image of the light on the paper change when you tip the tray?

   b. Do you observe any difference in the brightness of the light coming from the flashlight? Describe your observations.

   c. Do you observe any difference in the brightness of light hitting the surface of the paper? Describe your observations.

Part II

1. Set the images side by side and compare them.
    a. Which image is bigger: “straight on” or “at an angle”?
    b. Which one is smaller: “straight on” or “at an angle”?
2. Now, count the number of squares on each of the images.
    a. On each image, write the number of squares that the light covered. (Do not count any partial squares, only whole squares.)
    b. Which image covers the most squares?
3. Put away all your supplies except for the two images of the light on the graph paper.
4. Let your teacher know that you are ready to post the images you cut from the graph paper.
5. Begin your Analogy Map to help you connect the energy angles activity to the real world. How is the model we used like the real world and how is it different?

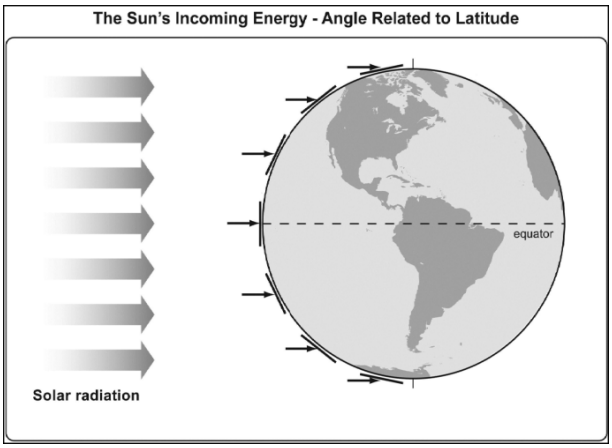
Analogy Map

Part of the model		Part of the real world	They are alike because	They are different because
	...is/are like…			

_____ WAIT FOR INSTRUCTIONS TO GO ON TO PART III _____

Part III

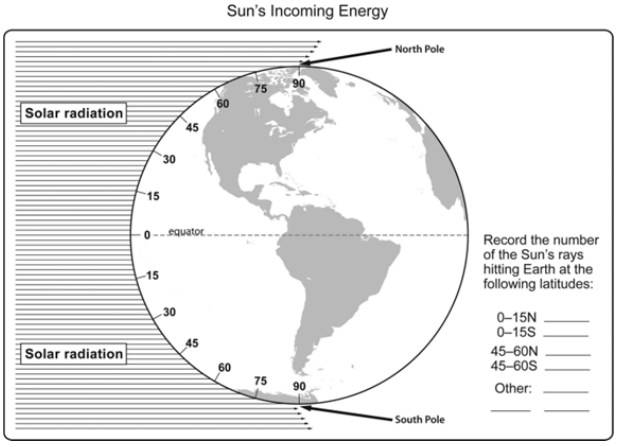
1. With your partners, review the Sun's Incoming Energy – Angle Related to Latitude diagram. Use your analogy map to make connections between this diagram and your flashlight-tray model. On the diagram below, label the model parts.



2. With your partners, review the Sun's Incoming Energy diagram handout. The numbers along the edge of the diagram of the Earth represent lines of latitude. The lines of latitude between the equator and the North Pole are north latitudes and the lines of latitude between the equator and the South Pole are south latitudes.

    a. How many light rays hit Earth's surface at the latitudes closest to the equator? Write the number in the space on your handout.

    b. Count the number of light rays hitting Earth's surface at the other latitudes and record the latitude and number on the space on your handout.

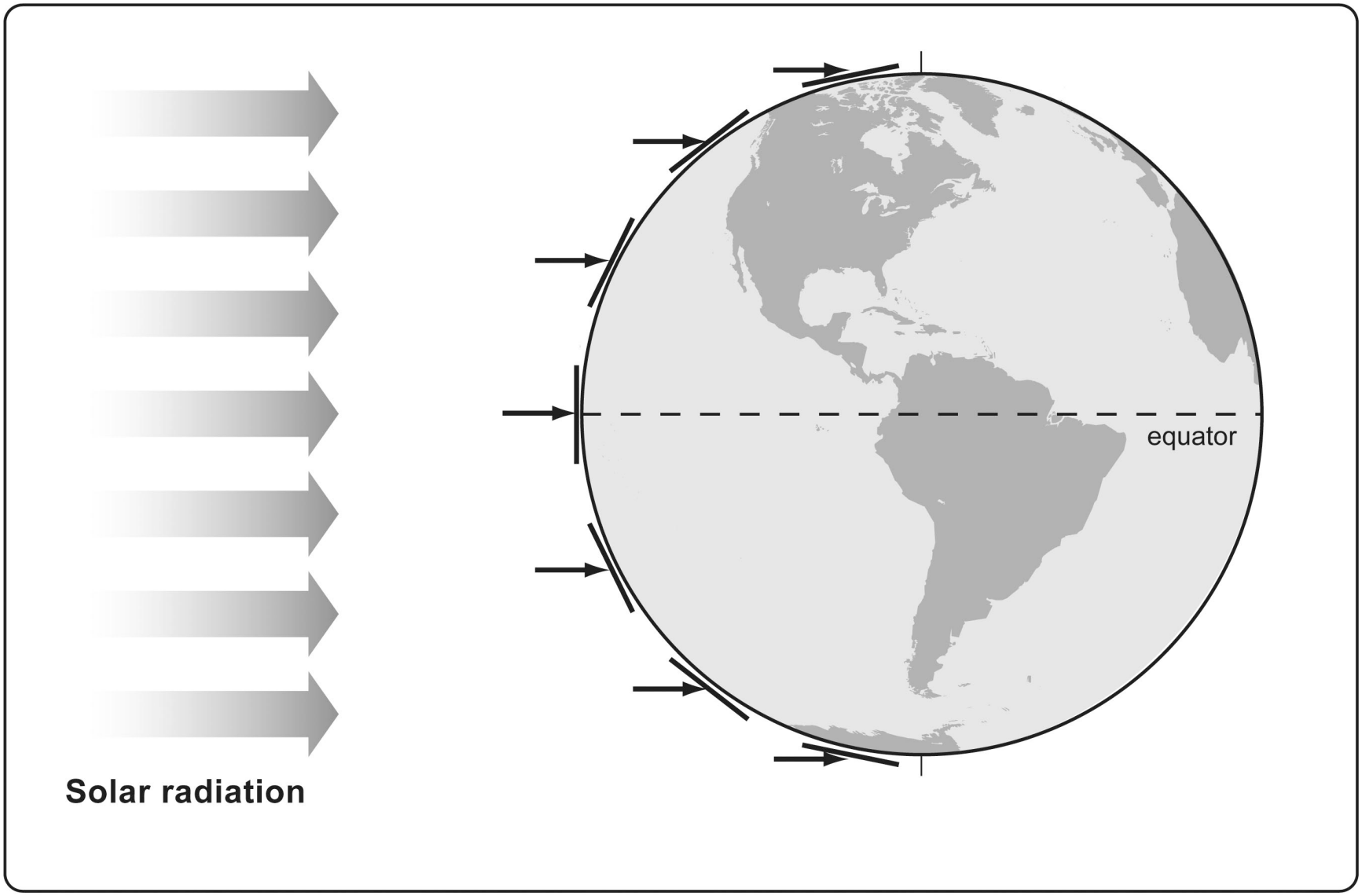


3. What pattern do you notice in the numbers you have recorded? Where on Earth is the Sun's light energy more concentrated? What is your evidence? Where on Earth is the Sun's energy more spread out? What is your evidence?

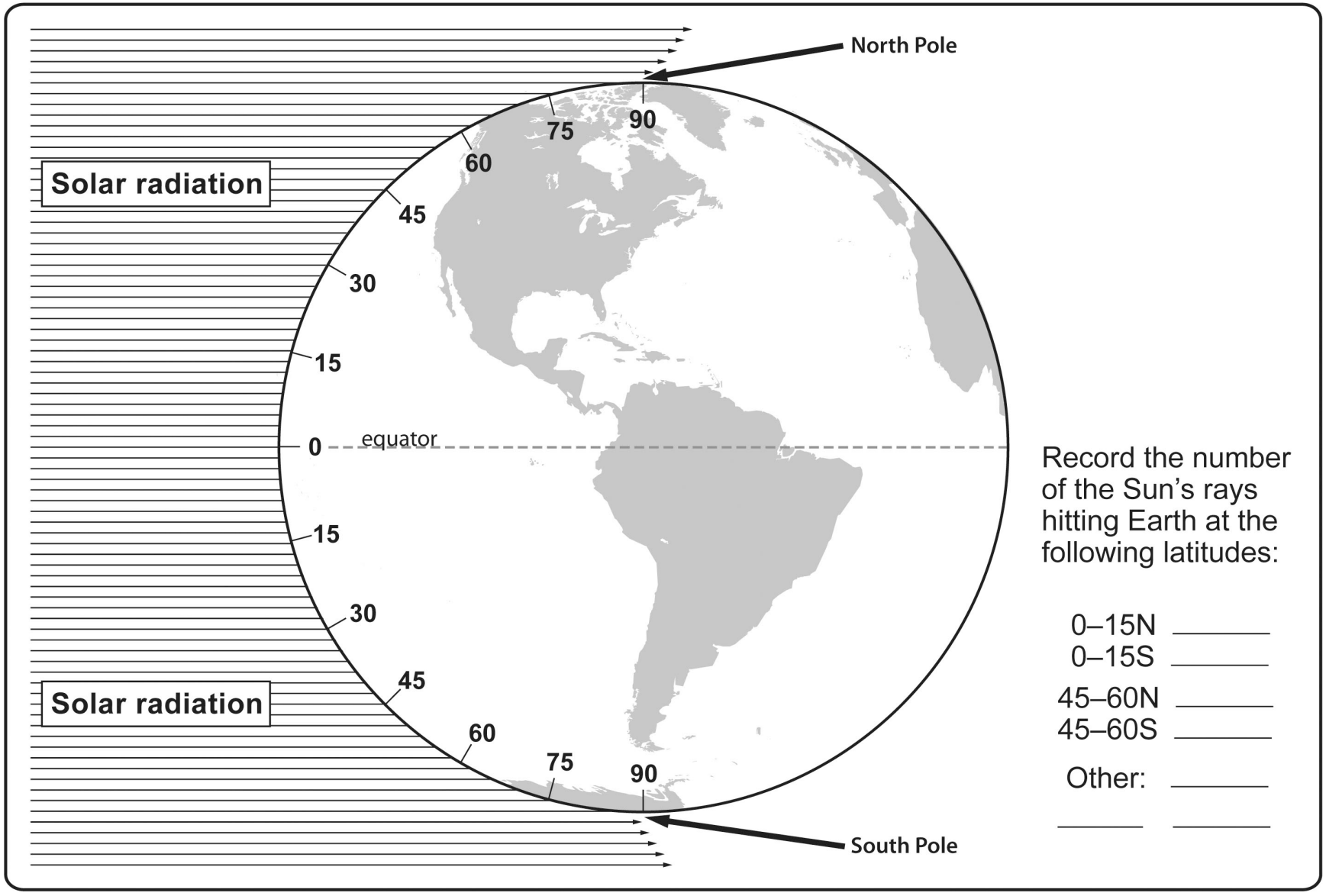
4. Think about this question: How does the number of the Sun's rays hitting Earth's surface connect to the activity you did with the flashlight? Use what you learned from these activities to answer the focus question: What causes the average temperatures on Earth near the equator to be higher than the average temperatures on Earth far from the equator?

Activity adapted from BSCS. (1999). *Investigating Weather Systems.* Dubuque, IA: Kendall/Hunt Publishing.

The Sun’s Incoming Energy - Angle Related to Latitude



Sun’s Incoming Energy



Record the number of the Sun’s rays hitting Earth at the following latitudes:

0–15N _____
0–15S _____
45–60N _____
45–60S _____
Other: _____
_____ _____

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