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Looking Up! What is our place in the universe? - An Astronomy UbD for 8th Grade

Miguel Angel Webber
webber.miguelangel@gmail.com

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8GrSci Looking Up - What is our place in the universe?

Unit Title	***Looking Up - What is our place in the universe?***	Course(s)	8th Grade Science
Designed by	Miguel Angel Webber Martinez	Time Frame	**17 Class Days:** W1 *August 26 - 30 (5)* W2 *September 3 - 6 (4)* W3 *September 9 - 13 (5)* W4 *September 16 - 18 (3)*

Stage 1- Desired Results

Establish Goals

8th Grade Science TEKS

- **8.8A** Describe components of the universe, including stars, nebulae, and galaxies. Use models such as the Hertzsprung-Russell diagram for classification.
- 8.8B Recognize that the Sun is a medium-sized star located in a spiral arm of the Milky Way galaxy, and that the Sun is many thousands of times closer to Earth than any other star.
- 8.8C Identify how different wavelengths of the electromagnetic spectrum, such as visible light and radio waves, are used to gain information about components in the universe.
- *8.8D* Research how scientific data are used as evidence to develop scientific theories to describe the origin of the universe.

Bolding denotes readiness TEKS. *Italics denote TEKS not assessed in curriculum.*

Transfer

Students will be able to independently use their learning to….

- Get a sense of perspective regarding place, size, and scale
- Understand how scientists can infer things we can't observe directly
- Use current data to learn about the past and make predictions about the future
- Communicate effectively with younger students

Meaning

UNDERSTANDINGS

- Many different kinds of objects exist in the universe.
- The Earth is infinitesimal when compared to the universe.
- Scientists must use many different methods to gather data about the universe.
- Data measured now can help us understand the past and predict the future.
- The universe and all things in it were born once and will die someday.
- Light isn't instantaneous, it travels at a given speed. This means when we look at the stars, we're seeing what they looked like in the past.

Essential Questions

- ***Who are we?***
- ***What is our place in the universe?***
- ***Why do people look up?***

- How big is our planet? Our galaxy? Our universe?
- How can we use present observations to learn about the universe's past?
- How can we use present observations to predict the universe's future?

Acquisition

Students will know...	***Students will be skilled at...***
• The universe is composed of many different kinds of objects, including stars, nebulae, and galaxies. • We can classify stars by their brightness and temperature using the Hertzsprung-Russell diagram. • The Hertzsprung-Russell diagram can be used to explain the stars' life cycle. • Stars are born in nebulae, fuse hydrogen into helium during their main sequence, and finally swell to become red giants or red supergiants before dying and becoming planetary nebulae, white dwarves, neutron stars, or black holes. • The Earth is one of many (8+) planets orbiting our star, the Sun. • The Sun is one of many (100-400 billion) stars in our galaxy, the Milky Way. • The Milky Way is one of many (54+) galaxies in our galaxy group, the Local Group. • The Local Group is one of many (100+) groups and clusters in our supercluster, the Virgo Supercluster. • The Virgo Supercluster is one of many (4) branches of our larger supercluster, the Laniakea Supercluster. • The Laniakea Supercluster is one of many (5) parts of our local galaxy filament, the Pisces-Cetus complex. • The Pisces-Cetus complex is one of many (?) galaxy filaments that populate the space between voids in the observable universe. • The observable universe could be part of a much larger, even infinite, universe. • What we call "light" is just one kind of electromagnetic radiation, the visible part of the electromagnetic spectrum.	• Visualizing and interpreting data on the Hertzsprung-Russell diagram. • Writing written comparisons of different objects in the universe, stars at different stages of their life cycle, and different wavelengths of electromagnetic radiation. • Using different kinds of charts, such as a Venn diagram and T-diagram, to compare and contrast different objects in the universe, stars at different stages of their life cycle, and different wavelengths of electromagnetic radiation. • Predicting the future of stars given their mass and current state. • Comparing and contrasting the relative size and distance of different planets, stars, and galaxies. • Explain scientific concepts at a level appropriate for younger students.

• Scientists can use other parts of the electromagnetic spectrum to study far-away objects. ***Students will come into the unit knowing…*** • The physical properties, location, and movements of the Sun, planets, and moons (6.11A). • Gravity is the force that governs the motion of our solar system (6.11B). • The history and future of space exploration (6.11C). • The characteristics of objects in our solar system that allow life to exist (7.9A) • The accommodations, considering the characteristics of our solar system, that enabled manned space exploration (7.9B)	

Stage 2- Evidence

Evaluation Criteria	
Successful projects are… ***Creative*** ***Persuasive*** ***Accurate*** *Students are proficient at…*	**Performance Task** ***Students will show that they understand by evidence of…*** Writing a storybook! This assignment tasks each student with becoming a children's book author, and guiding their young readers on a journey through the cosmos. The ultimate goal of the storybook is to convince younger students to look up and appreciate our place in the universe. Each story must include a detailed visit of different kinds of objects in our solar system (including planets and moons), stars at each different stage of their life cycle, both kinds of nebulae, each different kind of galaxy, and the different levels of organization (planet/moon, star/solar system, group/cluster, supercluster, filament/void, universe). Students must show evidence that they understand the size of and distance between each of these objects, our

Creativity
Writing an engaging story aimed at a younger audience.
Illustrating the story with real photographs..

Persuasion
Convincing younger students to look up and study astronomy.
Providing constructive feedback for other young authors.
Following up on feedback and refining their work.

Accuracy
Including all requested components of the universe, including a real, named example of each.
Showing evidence of understanding the relative size and scale of different components of the universe.
Showing evidence of understanding the role of different wavelengths of EM radiation in astronomy.
Citing their sources.

solar system's location within the Milky Way, and the different wavelengths scientists use to visualize deep space objects— the latter by including example images taken with real telescopes.

This requires by necessity that students possess an ability not just to regurgitate definitions, but to explain concepts in their own words and in a way that unlocks understanding for younger students.

The writing will be heavily scaffolded to meet the needs of a diverse 8th grade population. Many younger students are intimidated by the idea of long-form writing, and middle school assignments often reinforce the idea that an assignment has to be written in a single marathon session. This is inauthentic to how people write in professional settings, with short, targeted sessions followed by a cycle of feedback and revisions. To that end, students will receive targeted prompts at the end of each class session, asking them to write a few sentences or even a short paragraph designed to fulfill one of the requirements of the storybook rubric. At the end of the unit, we will engage in a one-week storybook workshop. This consists of:

- Prior homework: Storyboard listing point of view, the main character or narrator, conflict, resolution, and mechanics.
- Two days to integrate the various prompts and create a rough draft.
- One day for structured feedback, where students will work in short groups to provide written criticism for three other students.
- One day to revise their work and respond to feedback.
- A final gallery walk where students will vote on what they think are the standout stories.

The rubric for this assignment is divided into two portions: a teacher-graded version and a self-graded reflection. In the teacher-graded version, I provide concrete statements for each criterion at each level of achievement. These criteria are designed to serve as guidelines for students as they work on their product. The student or self-graded version of this rubric has more subjective guidelines— I ask that every student's product is creative, persuasive, and accurate. To show me this, as well as to encourage revision and reflection, students must provide three pieces of evidence for each.

The final product will be read to sixth and seventh graders at our middle school, and the best stories (as voted by students in all grades) will be compiled into an online book and published as a resource for students of the world.

Other Evidence

Students will show they have achieved Stage 1 goals by…

Lesson	**Knowledge and Skills**	**Targeted Writing Prompt**
Watching for Meaning: The Big Bang and Three Ways to Destroy the Universe	• The universe is composed of many different kinds of objects, including stars, nebulae, and galaxies.	Why do you think humans throughout history have been fascinated with the idea of "looking up"? What can we gain by studying astronomy?
NAL: The Life Cycle of Stars	• Stars are born in nebulae, fuse hydrogen into helium during their main sequence, and finally swell to become red giants or red supergiants before dying and becoming planetary nebulae, white dwarves, neutron stars, or black holes.	You are familiar with our Sun, a yellow star in its main sequence. What do you think the Sun looked like as a protostar? What do you think the Sun will look like as a red giant? As a white dwarf?
Hertzsprung - Russell Graphic Organizer and Jigsaw	• We can classify stars by their brightness and temperature using the Hertzsprung-Russell diagram. • The Hertzsprung-Russell diagram can be used to explain the stars' life cycle.	You are familiar with our Sun, a yellow star in its main sequence. If it were five times hotter? Five times colder?
Metaphorical Expression: The Life Cycle of Stars	• Stars are born in nebulae, fuse hydrogen into helium during their main sequence, and finally swell to become red giants or red supergiants before dying and becoming planetary nebulae, white dwarves, or black holes.	Supernovae are so bright they can temporarily out-shine an entire galaxy. What would it look like from Earth if one happened in our closest neighbor galaxy, Andromeda? What would the resulting black hole look like from up close?
Mind's Eye: Levels of Organization of the Universe ○ NAL and graphic organizer	• The Earth is one of many (8+) planets orbiting our star, the Sun. • The Sun is one of many (100-400 billion) stars in our galaxy, the Milky Way. • The Milky Way is one of many (54+) galaxies in our galaxy group, the Local Group. • The Local Group is one of many (100+) groups and clusters in our supercluster, the Virgo Supercluster.	How long do you think it would take to travel far enough to be able to see our entire solar system at once? Our entire galaxy? Our entire group? Our entire supercluster? Our entire filament? How can we convey the idea of

	• The Virgo Supercluster is one of many (4) branches of our larger supercluster, the Laniakea Supercluster. • The Laniakea Supercluster is one of many (5) parts of our local galaxy filament, the Pisces-Cetus complex. • The Pisces-Cetus complex is one of many (?) galaxy filaments that populate the space between voids in the observable universe. • The observable universe could be part of a much larger, even infinite, universe.	great lengths of time and distance through writing? What will our characters have to go through to see all this?
Inductive Learning: Shapes of Galaxies	• The universe is composed of many different kinds of objects, including stars, nebulae, and galaxies.	Describe what we can see of our Milky Way galaxy from Earth. Why can't we see the spiral shape? What would it look like if we were seeing it head-on?
NAL: The Electromagnetic Spectrum ○ Telescope wavelength comparison and practice looking up images	• What we call "light" is just one kind of electromagnetic radiation, the visible part of the electromagnetic spectrum. • Scientists can use other parts of the electromagnetic spectrum to study far-away objects.	Why do you think scientists need to use different wavelengths to take pictures of deep space objects? What would they look like if our eyes could see in radio waves, infrared, or ultraviolet?
Jigsaw: The EM Spectrum, Telescopes, and the Skies Above ○ Review levels of organization: What do you know now about how these images were taken?	• The universe is composed of many different kinds of objects, including stars, nebulae, and galaxies. • What we call "light" is just one kind of electromagnetic radiation, the visible part of the electromagnetic spectrum. • Scientists can use other parts of the electromagnetic spectrum to study far-away objects.	What would your protagonist's ship need if they wanted to see all these different levels of organization? Think about the kinds of telescopes or cameras they would need, as well as the life support and engines they would need to get around in.

Stage 3- Learning Plan

Learning Events	Progress Monitoring
Student success at transfer, meaning, and acquisition depends upon… *Every class begins with a Hubble Picture of the Day, as well as a brief discussion of its significance and the wavelengths involved.* 1. **Day 1** a. Introduce the unit. Walk students through essential questions, and have students write down (brief) answers on the top half of a sheet of paper. Students will revisit these at the end of the unit. b. KWL: Why look up? Why have humans had a continued fascination with outer space? Astronomy is one of the oldest scientific disciplines, and you could even argue that it took a long time for Western society to catch up to ancient peoples' depth of knowledge. i. Butcher paper on whiteboard. Keep a separate one for each class, have students write on it through the unit (Chalk Talk). c. Introduce Storybook project. Have students read through the handout, storyboard, and writing prompts. Take questions and have students annotate their copy regarding the mechanics of the project (due dates are especially important). Stress the idea that this will be a gradual process, not a last-minute mad dash to write ten pages. **2. Day 2** a. Use a Reading for Meaning protocol to watch the two linked Kurzgesagt videos (see Resources/Materials). Give students writing time to finish the graphic organizer, then lead a whole-class discussion on the origin and end of the universe. This is a great time to figure out what's on kids' minds. b. Targeted Writing Prompt #1 **3. Day 3** a. New American Lecture on the Life Cycle of Stars. b. Lead students through creating a flowchart on the board for the various stellar masses and their fates. Have students copy this down in the graphic organizer (at the end of the slides). c. Targeted Writing Prompt #2 **4. Day 4** a. Hertzsprung-Russell Graphic Organizer and Jigsaw (link). Walk students through the front half, emphasizing the importance of the following discoveries: i. Not all stars are the same distance from Earth. ii. We can use reference stars to measure the absolute brightness of a star (how bright it is	Every class ends with ten-to-twenty minutes for storybook writing and development, scaffolded with individual prompts (listed under stage two). These serve as progress monitoring and exit tickets.

from a set distance), which is different from its relative brightness (how bright it is from Earth).

iii. If we can determine a star's absolute brightness and color/temperature, we can use its relative brightness to determine its distance to Earth.

b. Assign student groups to work on one of three spectral masses for the Jigsaw portion (back half) of the worksheet. Students can use their notes from Day 3 to determine what happens to each star in old age and in death, but will need to look up the average lifespan for each stellar mass online.

c. Targeted Writing Prompt #3

5. **Day 5**
   a. Metaphorical Expression (link). This serves as a formative assessment to check how well students understand the life cycle of stars prior to moving on to the next topic.
   b. Targeted Writing Prompt #4
6. **Day 6**
   a. Mind's Eye protocol to guide students through free-form drawing of the different levels of organization. What do they expect the scale to look or feel like?
   b. NAL on Levels of Organization. Students follow along on their graphic organizer (last page in slideshow).
   c. Targeted Writing Prompt #5
7. **Day 7**
   a. Inductive Learning. Students will sort galaxy cards into the appropriate groups and come up with category names (irregular, spiral, barred, elliptical). Class discussion on types of galaxies and how they think some were formed (or destroyed).
   b. Targeted Writing Prompt #6
8. **Day 8**
   a. NAL: The Electromagnetic Spectrum. Walk students first through why scientists use different wavelengths to gather information about deep space objects, and then through what these different images look like when converted to visible light for our human eyes to process.
   b. Practice looking up images on spacetelescope.org for the students' storybooks.
   c. Targeted Writing Prompt #7
9. **Day 9**
   a. Jigsaw: Electromagnetic Spectrum. Task each student group with finding different kinds of images, taken with: radio, microwave, infrared, visible light, ultraviolet, and gamma ray instruments. Lead a class discussion— How are these alike? How are they different?
   b. Review levels of organization NAL. What do you know now about how these images were taken?
   c. Targeted Writing Prompt #8
   d. Please remind students that the storyboard and all targeted writing prompts have to be completed before they walk into class the next day! Make sure students get their progress

tracker signed before they leave.

10. **Day 10**
    a. Storybook Rough Draft Work Day. Students must have completed all targeted writing prompts prior to this class day.
11. **Day 11**
    a. Storybook Rough Draft Work Day. Please remind students that their rough draft must be completed and ready for peer review before they walk into class tomorrow! Make sure students get their progress tracker signed before they leave.
12. **Day 12**
    a. Storybook Structured Peer Review. Assign students to groups of four (randomized or pre-planned according to class needs and teacher preference). Hold timed rounds:
        i. 5 minutes for the first author to read their storybook.
        ii. 5 minutes for the listeners to write warm and cool feedback.
        iii. Switch to the next author!
        iv. Use time left over to debrief the process and get suggestions for how to implement a better peer review next time.
        v. Make sure students get their progress tracker signed before they leave.
13. **Day 13**
    a. Storybook Final Draft Work Day. Please remind students that their final draft must be completed and ready for the gallery walk before they walk into class tomorrow! Make sure students get their progress tracker signed before they leave.
14. **Day 14**
    a. Storybook Gallery Walk. If time allows, students may begin completing their written reflections after the conclusion of the gallery walk.
15. **Day 15**
    a. Vocabulary Review: Two choices.
        i. Quizlet Live
        ii. GimKit
16. **Day 16**
    a. STAAR Prep Multiple Choice Summative Assessment
17. **Day 17**
    a. Test corrections! Have students complete one sentence explaining the source of their error and one sentence justifying the correct answer.
    b. Reflections. This should be finished first individually, using the attached reflection sheet, and then (ideally) in a group setting following the Community Circle protocol. Make sure students get their progress tracker signed and turned in with all signatures before they leave.

Resources / Materials

- SpaceTelescope.org
    - Wavelength Comparison
    - Top 100 Images
- Pew Research Center Poll on Space Exploration
- The Big Bang (Kurzgesagt)
- Three Ways to Destroy the Universe (Kurzgesagt)

Mission Bay High School UbD Unit Planner is from Wiggins, Grant and McTighe, Jay. *Understanding by Design Guide to Creating High-Quality Units*. Alexandria, VA: Association for Supervision and Curriculum Development. 2011.

Calendar

Monday	Tuesday	Wednesday	Thursday	Friday
August 26 • Unit Introduction • KWL: Why look up? Discussion. • Introduce Storybook	*August 27* • Watching for Meaning: The Big Bang and Three Ways to Destroy the Universe	*August 28* • NAL: The Life Cycle of Stars	*August 29* • Hertzsprung - Russell Graphic Organizer and Jigsaw	*August 30* • Metaphorical Expression: The Life Cycle of Stars
Student Holiday	*September 3* • Mind's Eye: Levels of Organization of the Universe ○ NAL and graphic organizer	*September 4* • Inductive Learning: Shapes of Galaxies	*September 5* • NAL: The Electromagnetic Spectrum ○ Telescope wavelength comparison and practice looking up images	*September 6* • Jigsaw: The EM Spectrum, Telescopes, and the Skies Above ○ Review levels of organization: What do you know now about how these images were taken?
September 9 • Storybook Rough Draft Work Day • Review content requirements	*September 10* • Storybook Rough Draft Work Day • Review format requirements	*September 11* • Storybook Peer Review (Microlab) • Submit structured feedback	*September 12* • Storybook Final Draft Work Day • Submit revisions	*September 13* • Storybook Gallery Walk
September 16 • Quizlet Live (or GimKit): Astronomy Vocabulary	*September 17* • STAAR Prep Summative Assessment	*September 18* • Test Corrections • Reflections ○ (Community Circle)	*...off to the next unit!*	

Storybook - Student Handout

Houston, we have a problem...

Did you know that only 18% of Americans think that sending a human to Mars should be a top priority for NASA? That only 13% believe that sending more humans to the Moon should be? A Pew Research Center poll, released on June 9, 2018, revealed that, although public support for NASA is growing, the vast majority of people believe NASA should center its research on Earth.

Our species-wide, ten-thousand-years-long fascination with outer space seems to be winding down, maybe even coming to an end. Why?

In this unit, you will show me everything you learned about astronomy not by memorizing facts and answering multiple choice questions, but by writing a storybook. Become a children's book author! You will explain scientific concepts accurately and in your own words, engage your readers with a creative storyline, and ultimately convince younger students that outer space is worth studying.

You might be wondering— "But I'm not a children's book author. How am I supposed to write a good storybook?" Here's how.

1. At the end of every lesson, complete the short writing prompt for the day. This will either be finished in-class or for homework every day, and never be more than a few sentences. Each writing prompt is relevant to the requirements for the final storybook, so if you finish all the writing prompts, you'll just have to connect them with a narrative and put on the finishing touches. These are due after each class, but the final deadline to have all the prompts completed is **before class on Monday, September 9.**
2. At the end of the unit, you will have two in-class days to work on your story and make sure you have all the requirements from the rubric (including the illustrations). Use the storyboard to help! The rough draft is due **before class on Wednesday, September 11.**
3. The next day, you will have one in-class day to work with three of your peers in a structured feedback session. You will take turns reading your stories out loud to your small groups while your peers write warm and cool feedback to help you make your storybook amazing. This feedback is due to each of your peers **by the end of class on Wednesday, September 11.**
4. After you've read and processed the feedback you got, you will have one in-class day to work on responding to criticisms and polish your work into a publication-ready final draft. This final draft is due **before class on Friday, September 11.**
5. On Friday, you will get the chance to read your storybook to your peers in a gallery walk. We will vote on the best ones, and I will take those and integrate them into a digital library for publication so that children around the world can read your work.

Get your work initialed here by Mr. Webber Martinez:

Writing Prompts	*Storyboard*	*Rough Draft*	*Feedback & Response*	*Final Draft*	*Reflection*

Storybook - Daily Writing Prompts

Targeted Writing Prompt	**Write here! Use a different sheet if you need to, but staple it to this book.**
Why do you think humans throughout history have been fascinated with the idea of “looking up”? What can we gain by studying astronomy?	
You are familiar with our Sun, a yellow star in its main sequence. What do you think the Sun looked like as a protostar? What do you think the Sun will look like as a red giant? As a white dwarf?	
You are familiar with our Sun, a yellow star in its main sequence. If it were five times hotter? Five times colder?	
Supernovae are so bright they can temporarily out-shine an entire galaxy. What would it look like from Earth if one happened in our closest neighbor galaxy, Andromeda? What would the resulting black hole look like from up close?	

How long do you think it would take to travel far enough to be able to see our entire solar system at once? Our entire galaxy? Our entire group? Our entire supercluster? Our entire filament? How can we convey the idea of great lengths of time and distance through writing? What will our characters have to go through to see all this?	
Describe what we can see of our Milky Way galaxy from Earth. Why can't we see the spiral shape? What would it look like if we were seeing it head-on?	
Why do you think scientists need to use different wavelengths to take pictures of deep space objects? What would they look like if our eyes could see in radio waves, infrared, or ultraviolet?	
What would your protagonist's ship need if they wanted to see all these different levels of organization? Think about the kinds of telescopes or cameras they would need, as well as the life support and engines they would need to get around in.	

Storybook - Storyboard

What will be my story's **title**? How can I grab my reader's attention?	Who will be my **protagonist**? What is their name?	What is their **motivation**? Why are they traveling to outer space?	What are they like? Think about their personality, ethnicity, gender, and any other aspect that helps you connect to them.
What will be my **conflict**? What problem will my protagonist find?	How can I **introduce** this conflict? When should I introduce it?	How will my protagonist **resolve** this conflict? What do they do to fix it?	Are there any **consequences** for the protagonist afterwards?
For the objects below, include a specific name (to include in the story and to help you find an accurate photograph) and a brief description.			
Planet 1 (in our solar system): Planet 2 (outside our solar system):	Moon 1: Moon 2:	Star 1: Type: Star 2: Type: Star 3: Type:	Nebula 1 (Planetary): Nebula 2 (Stellar Nursery):
Galaxy 1: Type: Galaxy 2: Type:	Group or Cluster:	Supercluster:	Filament:

Storybook - Feedback and Response

Author One: _____	*Warm feedback:* • • •	*Cool feedback:* • • •	*How will I (the author) respond?:* • • •
Author Two: _____	*Warm feedback:* • • •	*Cool feedback:* • • •	*How will I (the author) respond?:* • • •
Author Three: _____	*Warm feedback:* • • •	*Cool feedback:* • • •	*How will I (the author) respond?:* • • •

Storybook - Rubric

Name: _____ Class Period: ___		*Novice*	****** Proficient ******	*Artisan*
CREATIVITY	**Aim it at a younger audience (4th through 6th grade)**	Words too basic or too complex.	**Straightforward language.**	Exceptionally well-written.
	Write it in your own words.	"Borrowed" phrasing (instant zero, must rewrite storybook)	**Written in your own words.**	Exceptionally well-written.
	Include a central narrative or fictional element (story).	Missing or shoved-in story.	**The story has an introduction, conflict, and resolution. A protagonist narrates the story.**	Thrilling story, can't put it down.
	Illustrate it with real photographs for each object you visit. (From spacetelescope.org)	Missing photographs, illustrated by hand, used other sources.	**One photograph per object visited, clearly labeled.**	Additional photographs included, or using different wavelengths for comparison.
PERSUASION	**Try to convince younger students to study astronomy.**	Missing or lackluster persuasion.	**Convinces the reader astronomy is important.**	Makes you want to switch careers.
	Provide feedback to three other authors.	Feedback meaningless or missing.	**Meaningful, detailed feedback delivered to three peers on time.**	Exceptionally detailed, helpful feedback.
	Follow up on the feedback you got and refine your work.	Ignores feedback, does not refine rough draft before turning in the final draft.	**Responds to feedback, explains how the feedback helped change the rough draft into the final draft.**	Delivers hand-written thank-you notes to peers who gave feedback.
ACCURACY	**Include real, named: planets (1 in our solar system, 1 elsewhere), moons (2), stars (3 different types), nebulae (2 kinds), galaxies (2 kinds), group or cluster (1), supercluster (1), and filament (1).** *(14 objects total)*	Missing one or more components of the universe.	**Includes a named object for each requested category. Describes each object accurately.**	Includes additional objects.
	Include a citation for each photograph.	Missing one or more citations.	**Each photograph has a citation.**	Citations link back to original page on spacetelescope.org
	Show evidence of understanding both the relative size of each object and the relative distance between objects.	Does not mention levels of organization, does not mention size or distance.	**Mentions levels of organization, story includes relative travel time and impression of size.**	Calculates actual travel time between objects. Includes actual size of objects.
	Show evidence of understanding the role of different wavelengths in your story, and use at least three different kinds of electromagnetic radiation in your chosen photographs.	Does not mention different wavelengths. Does not include three different kinds of photographs (using different wavelengths).	**Mentions the importance of different wavelengths. Includes at least three different kinds of photographs (using different wavelengths).**	Makes the different wavelengths a meaningful part of the story. Uses more kinds of photographs.

Storybook - Reflection

How was I **creative**?			
How was I **persuasive**?			
How was I **accurate**?			
What am I **proud of**?			
What would I **do differently**?			