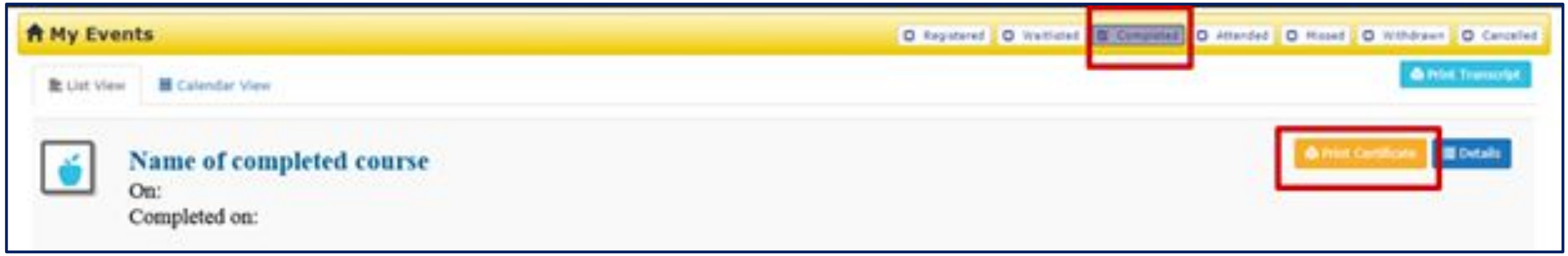
WELCOME!

Please review this information while we wait for all to join!

Attendance, Resources & PD Clock Hours

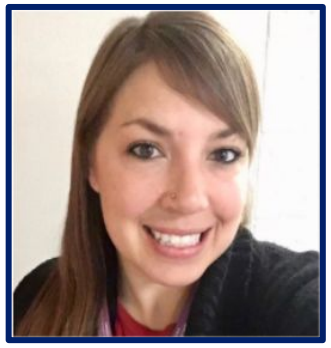
- **You must stay on the whole time- 1.5 hours- to receive credit**
- **<u>YOU</u> print your certificate through ADE Connect (see image)- please wait 24-48 hours of webinar before printing certificates**



- **AFTER WEBINAR- Survey & follow-up email from ADE**

Arizona Department of Education

Engaging Students in Developing & Using Models Using Digital Tools



Rebecca Garelli
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Harelson Elementary
Graduate Student, NAU
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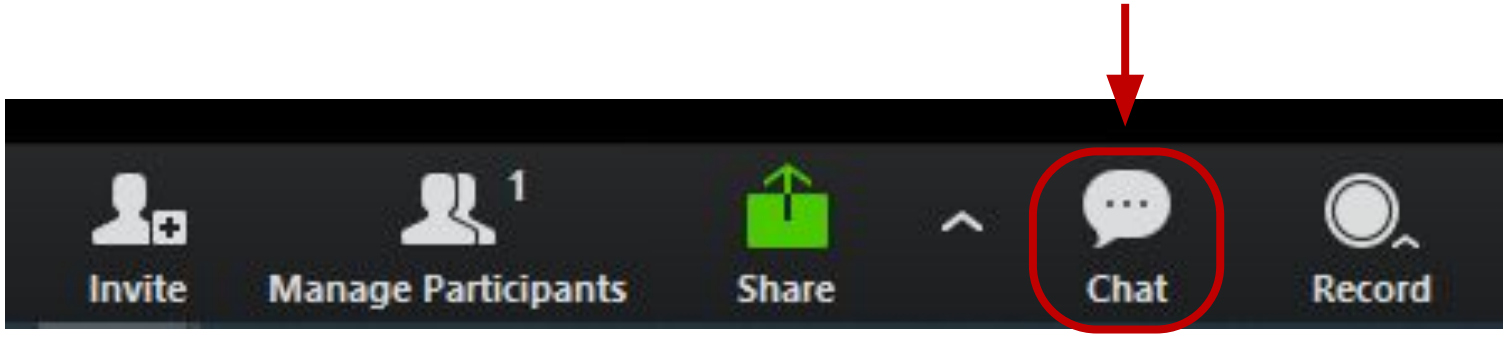
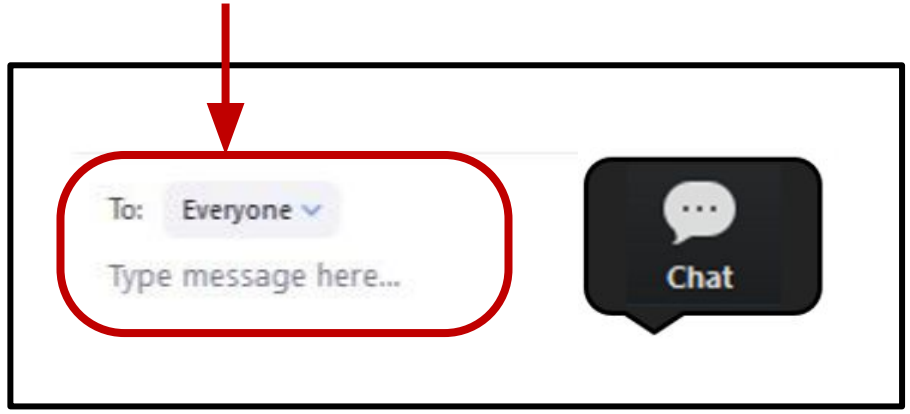
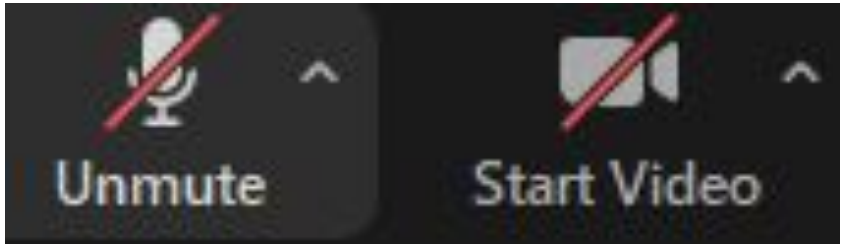
ryewell@amphi.com

Arizona Department of Education

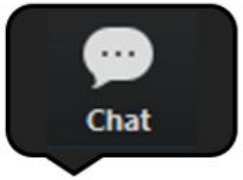
Webinar Housekeeping







Welcome!



- Name
- Current Position
- County
- How did you hear about this PD?

Webinar Resource Dashboard

Engaging Students in Developing and Using Models Using Digital Tools Webinar Dashboard for 5.18.21

Facilitators: **Rebecca Garelli:** Rebecca.Garelli@azed.gov I **Robyn Yewell:** ryewell@amphi.com

ADE Science Standards Page I ADE Science Resource Page I ADE Science & STEM Webinars

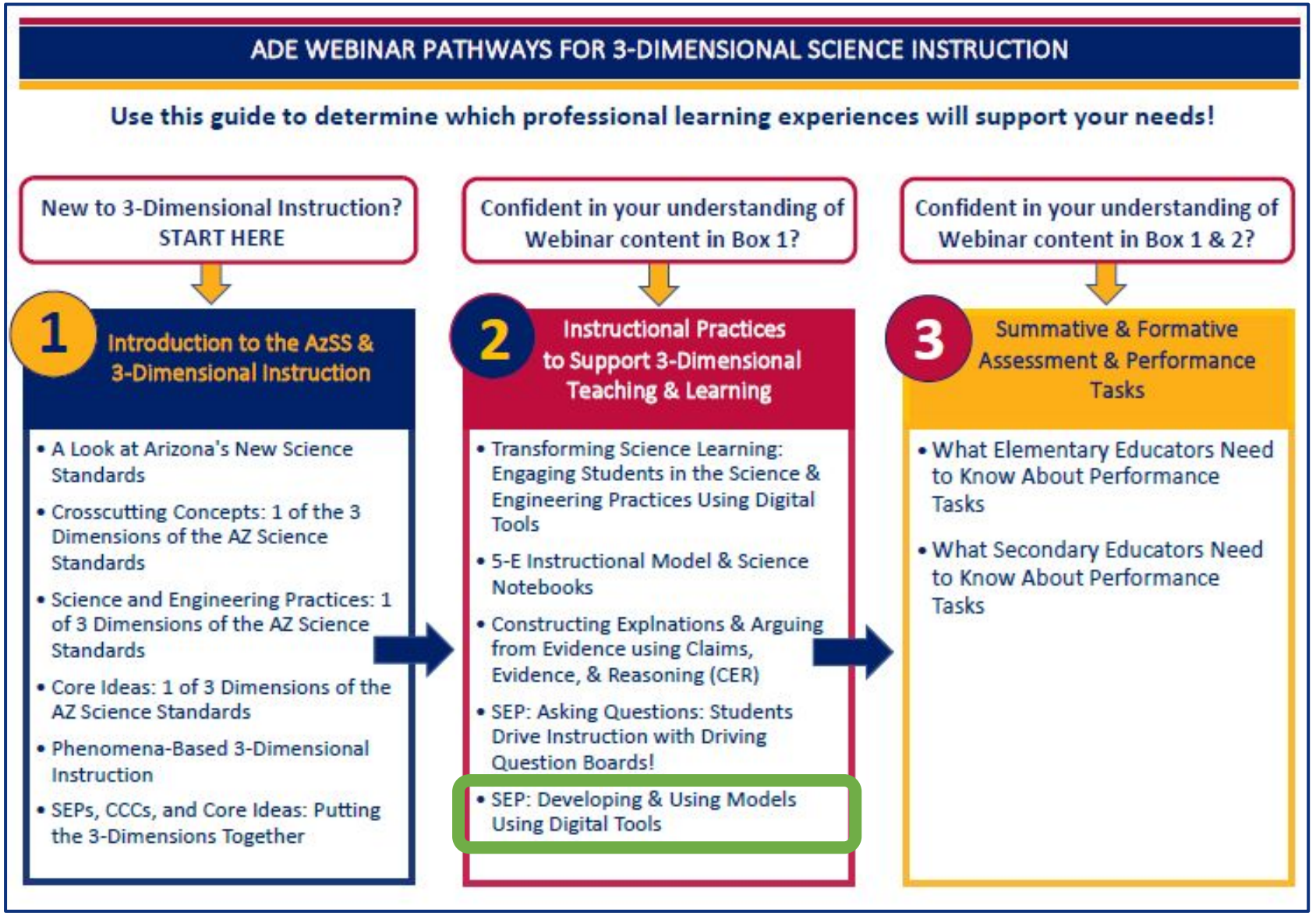
1	General Resources	⊕ Presentation PDF: PDF of Slides ⊕ ADE Webinar Pathways
2	3 Categories of Science & Engineering Practices	⊕ Assessing Practices Along a Continuum Article from NSTA ⊕ The Wonder of Science 3-D Cards
3	Going 3D with GRC Lesson Website and Resources	⊕ #Going 3D w/GRC ⊕ 5th Grade GRC Lesson Used in this Webinar ⊕ The Hawaiian Star Compass Video (vimeo)
4	AzSS vs. NGSS Planning Summaries	⊕ K-12 Planning Summaries

MAKE A FORCED COPY

Gray- means we will open and use

Webinar Pathways

#1 in Dashboard



WHAT, HOW, WHY

- Explore how to engage students with a phenomenon to launch a learning sequence that incorporates the Science & Engineering Practice (SEP) of Developing & Using Models and two Crosscutting Concepts (patterns and scale, proportion & quantity)

- Explore a few digital strategies to help students to develop, revise, and use models based on evidence to construct explanations.

- Deepen understanding of what the SEP of Developing & Using Models incorporates and how it relates to the AZ Science Standards

Community Norms/Shared Agreements

- We honor each other and all our voices
- We actively and respectfully listen and speak to one another
- We commit to the group by contributing to the learning of others through active participation in this web seminar.

Access to Science Literacy for ALL Students

economically disadvantaged

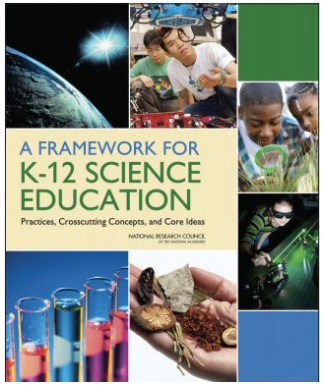
English learners

race and ethnicity

gifted and talented

students with disabilities

students with different cultures



Adapted from NSTA's Webinar- Transforming Science Learning: Acting, Thinking and Talking as Scientists. Engaging Students in Science and Engineering Practices on 8/12/20

Lesson Design for Sensemaking

- Phenomena
- Science and Engineering Practices
- Student Ideas
- Classroom Norms

Adapted from NSTA's Webinar- Transforming Science Learning: Acting, Thinking and Talking as Scientists. Engaging Students in Science and Engineering Practices on 8/12/20

Science & Engineering Practices

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Adapted from NSTA's Webinar- Transforming Science Learning: Acting, Thinking and Talking as Scientists. Engaging Students in Science and Engineering Practices on 8/12/20

Science & Engineering Practice (SEP): Developing & Using Models

Where do you fall on this spectrum?

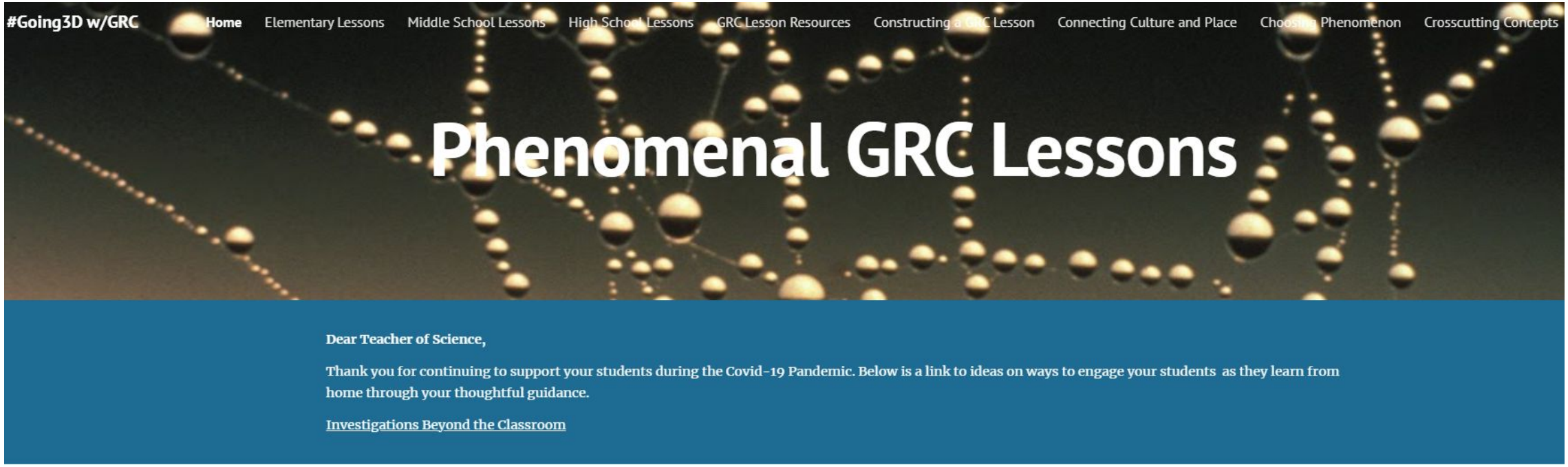
I know this SEP: Developing & Using Models exists

I can engage my students in the SEP: Developing & Using Models

I can confidently engage my students in the SEP: Developing & Using Models

Adapted from NSTA's Webinar- Transforming Science Learning: Acting, Thinking and Talking as Scientists. Engaging Students in Science and Engineering Practices on 8/12/20

#Going3Dw/GRC Lesson Website



#3 in Dashboard

3	Going 3D with GRC Lesson Website and Resources	⊕ #Going 3D w/GRC ⊕ 5th Grade GRC Lesson Used in this Webinar ⊕ The Hawaiian Star Compass Video (vimeo)

#Going3Dw/GRC 5th Grade Lesson

Performances

Phenomenon: Some stars are brighter than other stars.

Group Performances:

1. ***Ask questions*** about what ***causes*** some stars to be/appear brighter than others.
2. ***Obtain and evaluate*** information from the Stellarium App on the star's distance from Earth and its ***effect*** on apparent brightness.
3. ***Analyze data*** to determine ***patterns*** in the relationship between a star's distance from Earth and its apparent brightness.
4. ***Develop a model*** to show how the ***scale*** of distance to stars ***affects*** apparent brightness.

Class Discussion

Group Performance

5. ***Construct an explanation*** for how the ***scale*** of distance to stars ***affects*** the apparent brightness of the stars.

Individual Performance:

6. ***Develop an argument*** for how the apparent brightness of the sun compared to other stars is due to the ***scale*** of distance from Earth.

Blue = Science & Engineering Practices

Green = Crosscutting Concepts

#3 in Dashboard

3	Going 3D with GRC Lesson Website and Resources	⊕ #Going 3D w/GRC ⊕ 5th Grade GRC Lesson Used in this Webinar ⊕ The Hawaiian Star Compass Video (vimeo)

Arizona 2018 Science Standards & AzSS vs. NGSS Planning Guide

Arizona's 2018 Science Standards Summary & AzSS vs. NGSS Planning Guide – 5th Grade

Arizona Science Standards- 5th Physical		Next Generation Science Standards- 5th Physical
5.P3U1.4 Obtain, analyze, and communicate evidence of the effects that balanced and unbalanced forces have on the motion of objects.	P	**3-PS2-1** Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.
5.P3U2.5 Define problems and **design solutions** pertaining to force and motion.	NC	There is no strong or partial correlation to an NGSS standard in this grade band.
5.P4U1.6 Analyze and interpret data to determine how and where energy is transferred when objects move.	P	**4-PS3-3** Ask questions and predict outcomes about the changes in energy that occur when objects collide.
	P	**4-PS3-1** Use evidence to construct an explanation relating the speed of an object to the energy of that object.

#4 in Dashboard

Arizona Science Standards in Lesson

Earth and Space Science (ESS) - Earth's Place in the Universe, Earth's Systems, Earth and Human Activity - 16 Investigations						
5-ESS1-1 *Differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth.*	Hoku - Can You See Me? *	HI	The relative brightness of stars and sun. 	***Phenomenon:*** *Some stars are brighter than other stars.*	GRC PIP	The lesson uses a free simulation to compare distance to stars of the same relative brightness. *Includes formative assessment*

Connected Arizona Science Standard

Earth and Space: Students develop an understanding of the how gravitational forces in space cause observable patterns due to the position of Earth, Sun, Moon, and stars.		
Arizona Science Standards- 5th Grade Earth & Space		**Next Generation Science Standards- 5th Grade Earth & Space**
5.E2U1.7 Develop, revise, and use models based on evidence to construct explanations about the movement of the Earth and Moon within our solar system.	P	**5-ESS1-2** Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.
5.E2U1.8 Obtain, analyze, and communicate evidence to support an explanation that the gravitational force of Earth on objects is directed toward the planet's center.	NC	There is no strong or partial correlation to an NGSS standard in this grade band.

Arizona Science Standards in Lesson

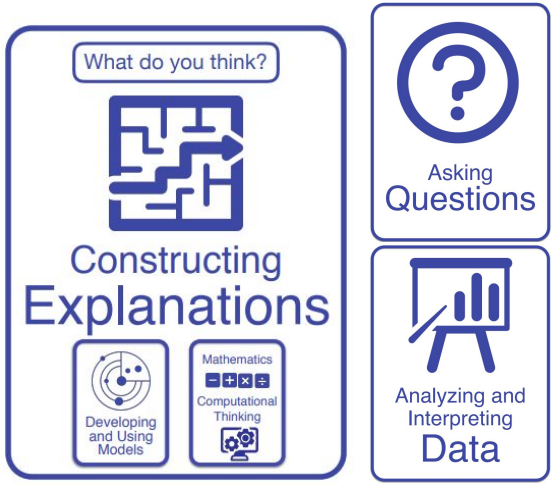
Connected Arizona Science Standard

5.E2U1.7 Develop, revise, and use models based on evidence to construct explanations about the movement of the Earth and Moon within our solar system.

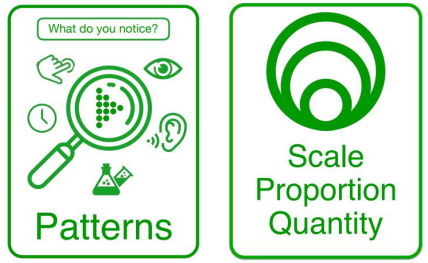
E2: The Earth and our solar system are a very small part of one of many galaxies within the Universe.

U1: Scientists explain phenomena using evidence obtained from observations and or scientific investigations. Evidence may lead to developing models and or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised.

Science & Engineering Practice(s)



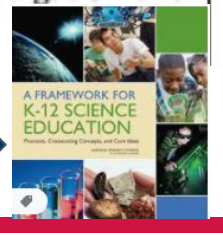
Crosscutting Concepts



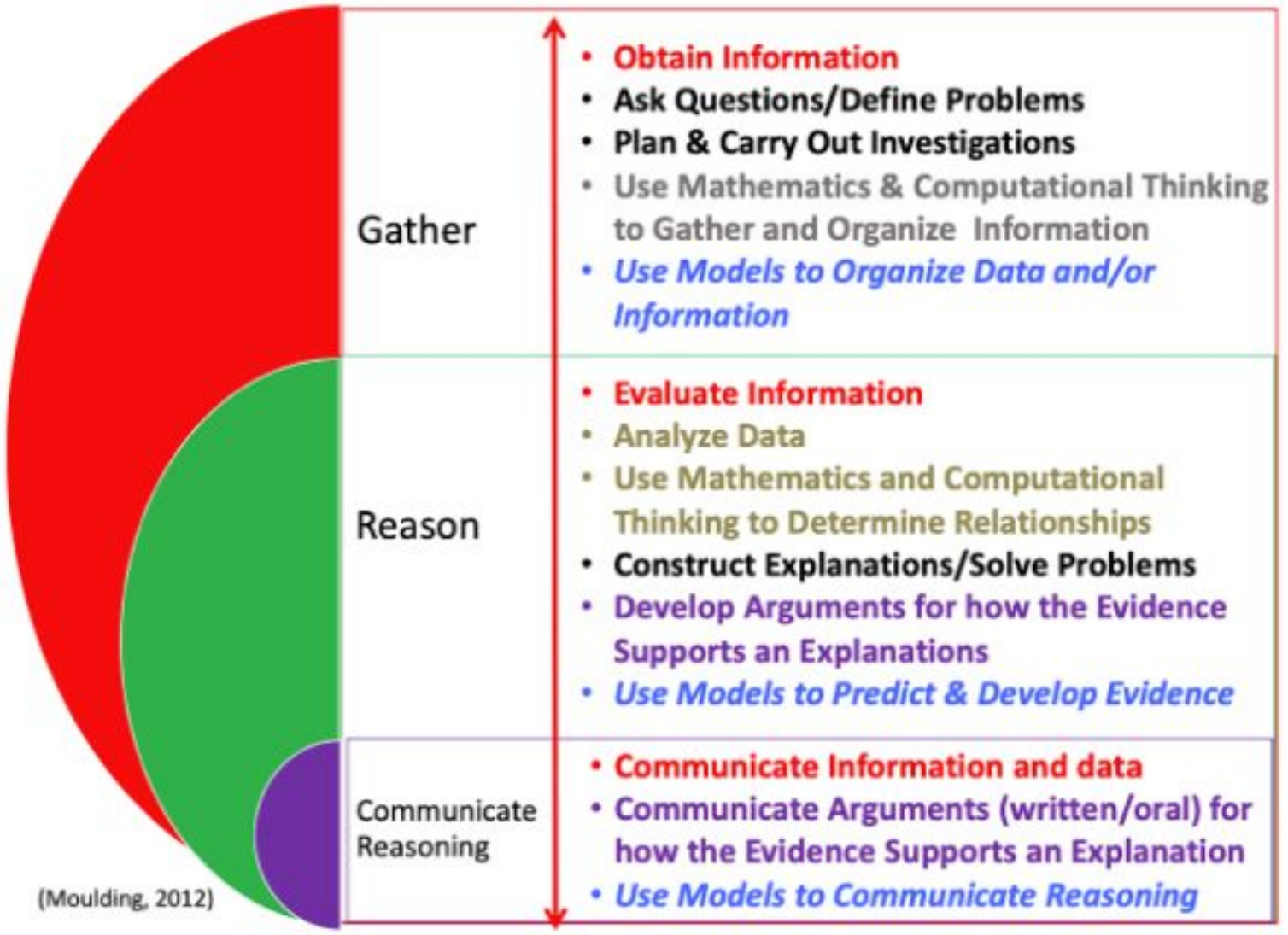
Arizona Science Standards in Lesson

Earth and Space Sciences: Students develop an understanding of the how gravitational forces in space cause observable patterns due to the position of Earth, Sun, Moon, and stars.

Earth and Space Standards	Crosscutting Concepts & Background Information for Educators
5.E2U1.7 Develop, revise, and use models based on evidence to construct explanations about the movement of the Earth and Moon within our solar system.	**Crosscutting Concepts:** **Patterns**, Cause and Effect, **Scale, Proportion and Quantity**; Systems and System Models; Energy and Matter; Structure and Function; Stability and Change[4] **Background Information:** The **Earth** moves round the **Sun** taking about a year for one orbit. The **Moon** orbits the Earth taking about four weeks to complete an orbit. The Sun, at the center of the solar system, is the only object in the solar system that is a source of visible light. The Moon reflects light from the Sun and as it moves round the Earth only those parts illuminated by the Sun are seen. The Earth rotates about an **axis** lying **north** to **south** and this motion makes it appear that the Sun, Moon and stars are moving round the Earth. The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause **observable patterns**. Some objects in the solar system can be seen with the naked eye. Planets in the night sky change positions and are not always visible from Earth as they orbit the sun. Stars appear in patterns called constellations, which can be used for navigation and appear to move together across the sky because of Earth's rotation. [4 p. 176]



#Going3Dw/GRC Lesson



#Going3Dw/GRC Lesson

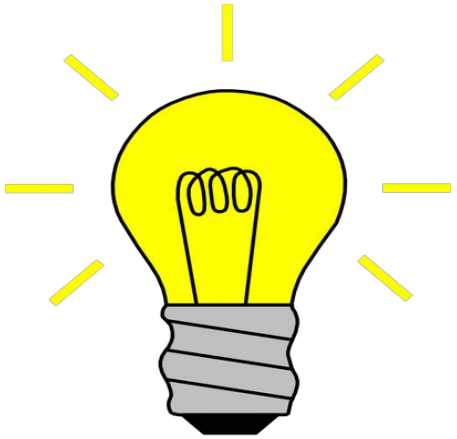
Instructional Sequencing for **Gathering, Reasoning, and Communicating** (GRC) for **Students**

1. Engage students in sensemaking with phenomenon.
2. Provide opportunities for students to **gather** information and data.
3. Allow students to **reason** through their explanations while you serve as the conversation facilitator.
4. Students **communicate** their reasoning to self and others.
5. Students will apply this learning beyond the classroom.

#Going3Dw/GRC Lesson

Phenomena Based Science Learning

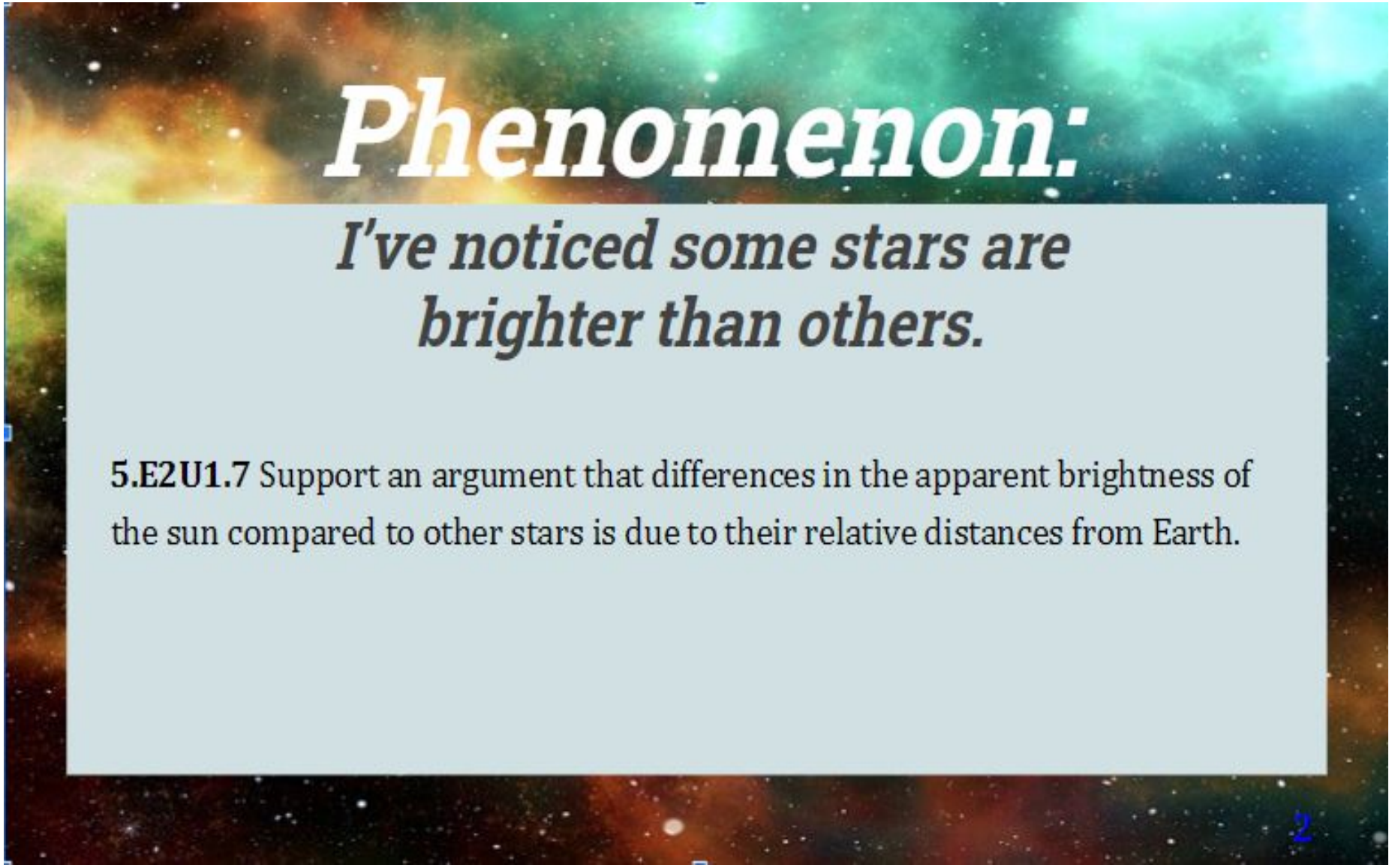
Engage students in observing phenomena and provide students the opportunity to develop meaningful questions to investigate the causes of the phenomena.



Students will **gather** information and data which they will use to support their explanations. Students will also **reason** to analyze data to use as evidence and **communicate** their findings.

Motivate students to apply their knowledge of science to make sense of other phenomena, outside of the classroom.

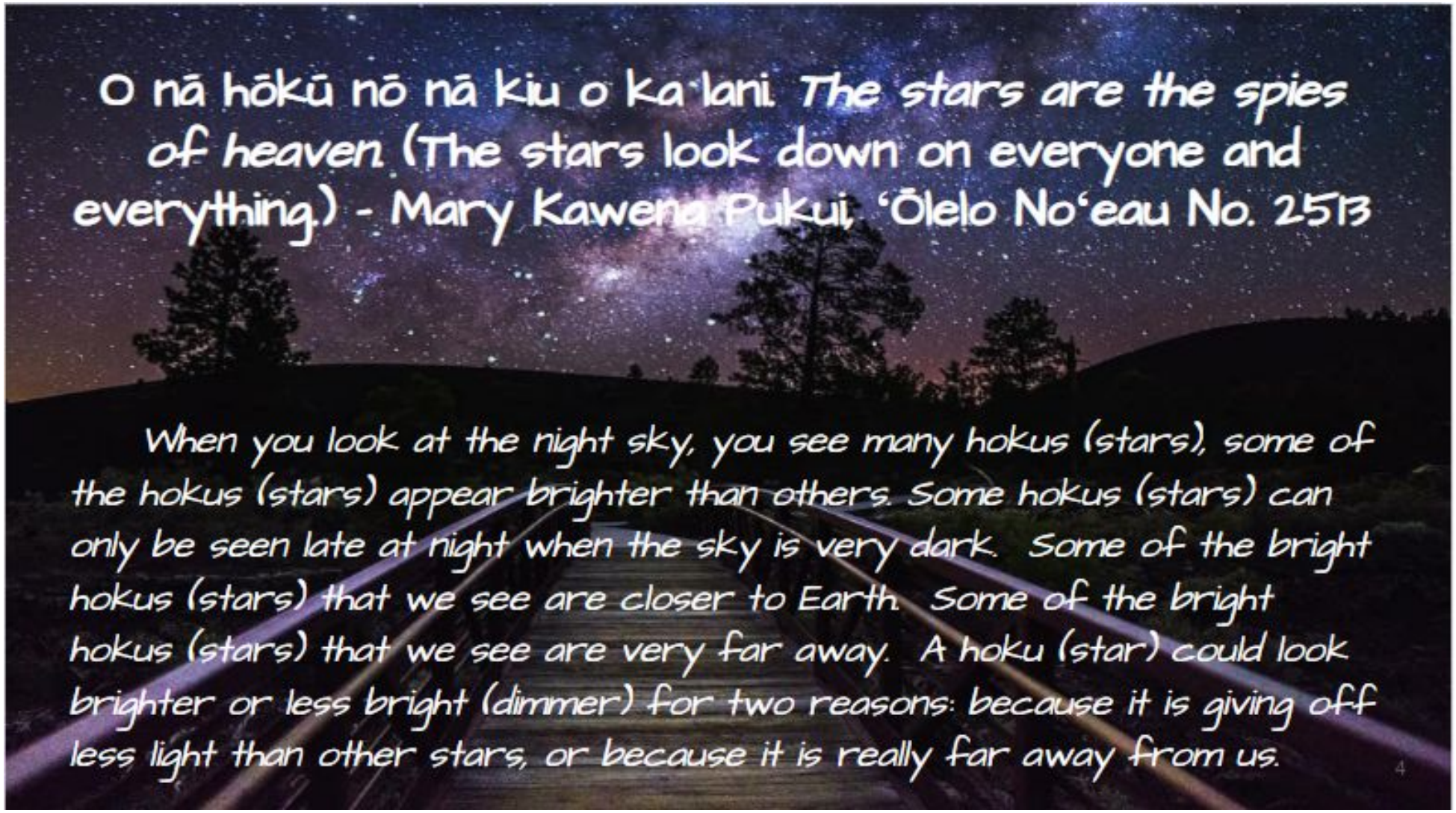
#Going3Dw/GRC Lesson



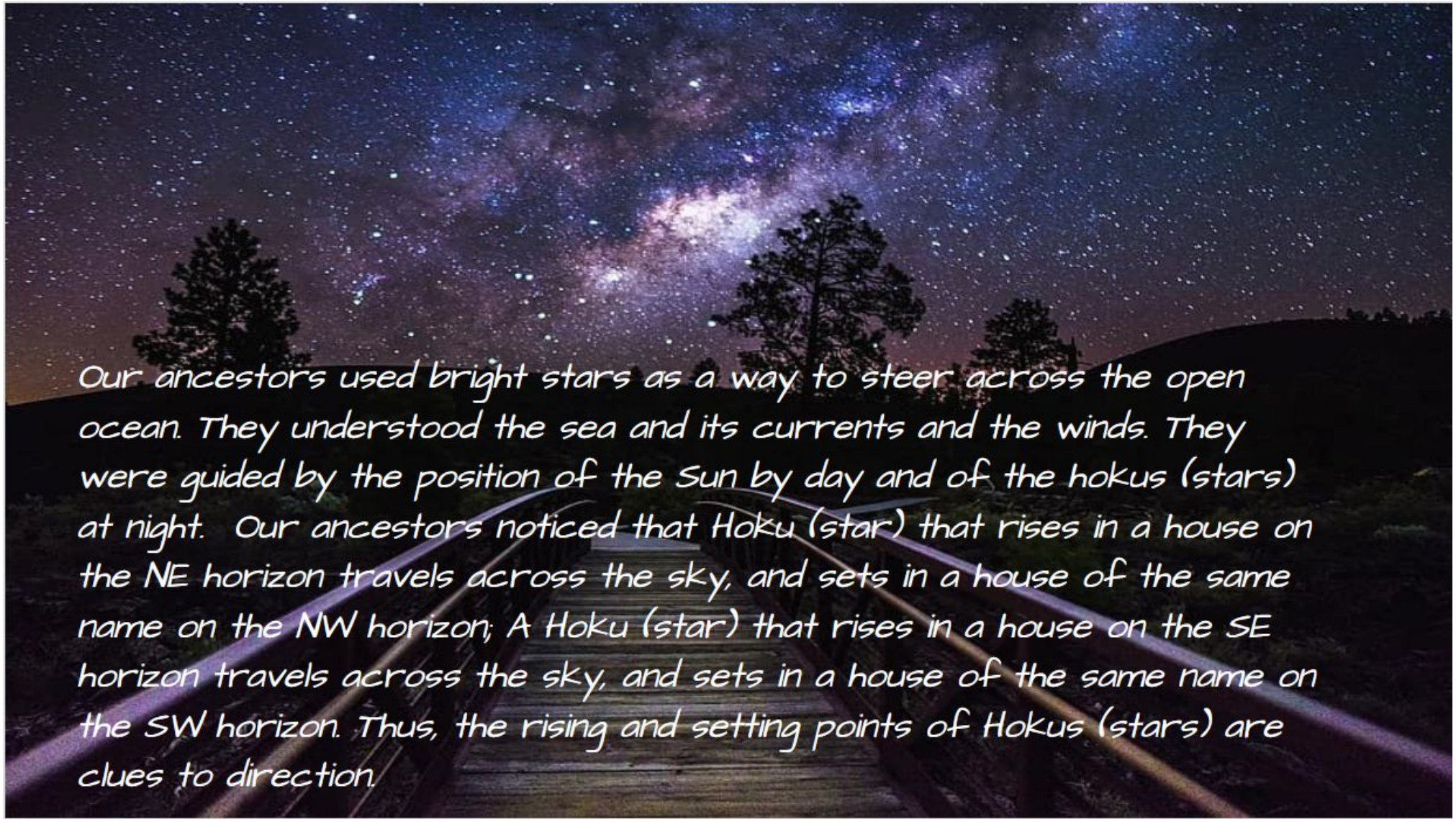
#Going3Dw/GRC Lesson

#3 in Dashboard

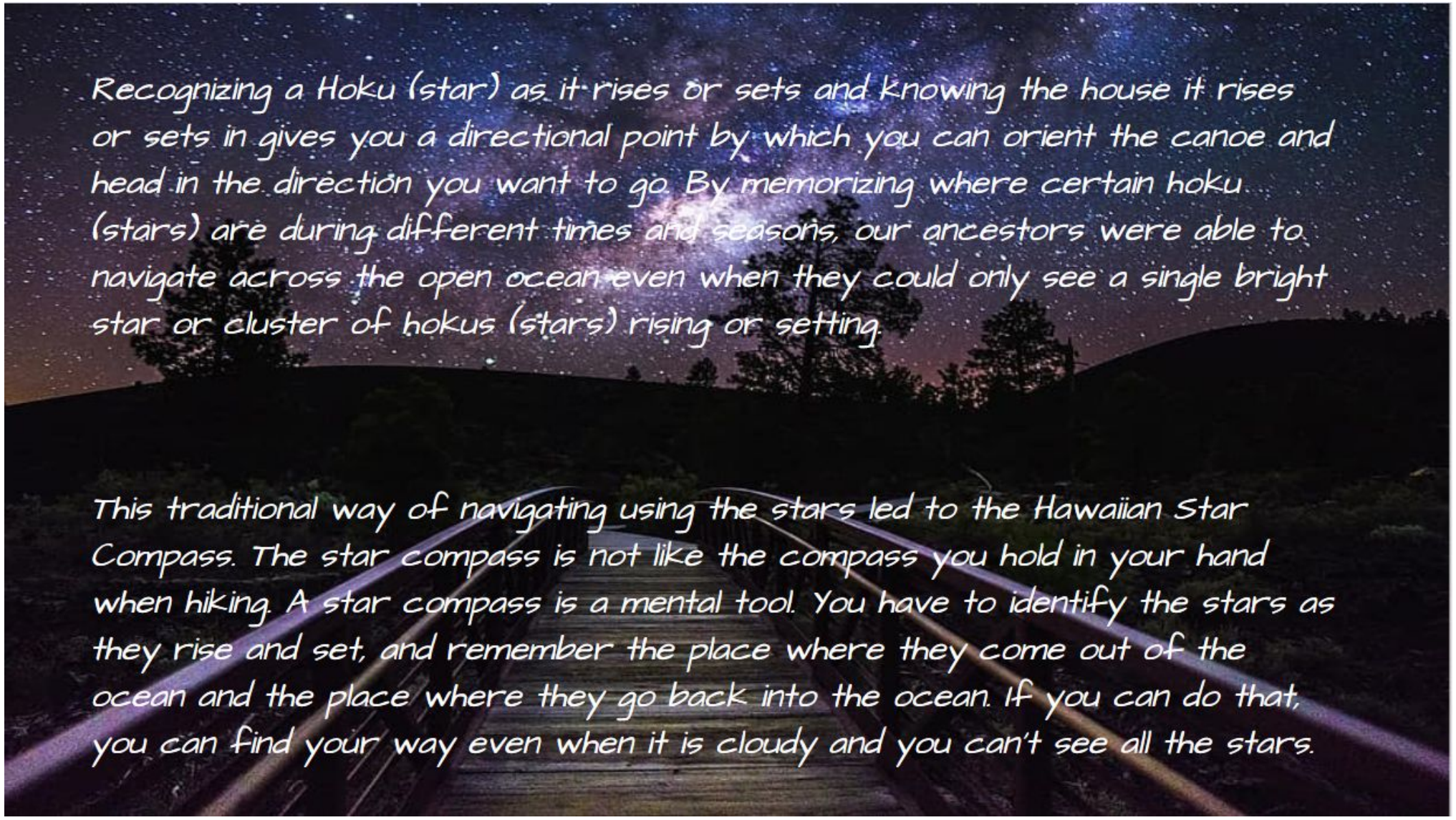
#Going3Dw/GRC Lesson



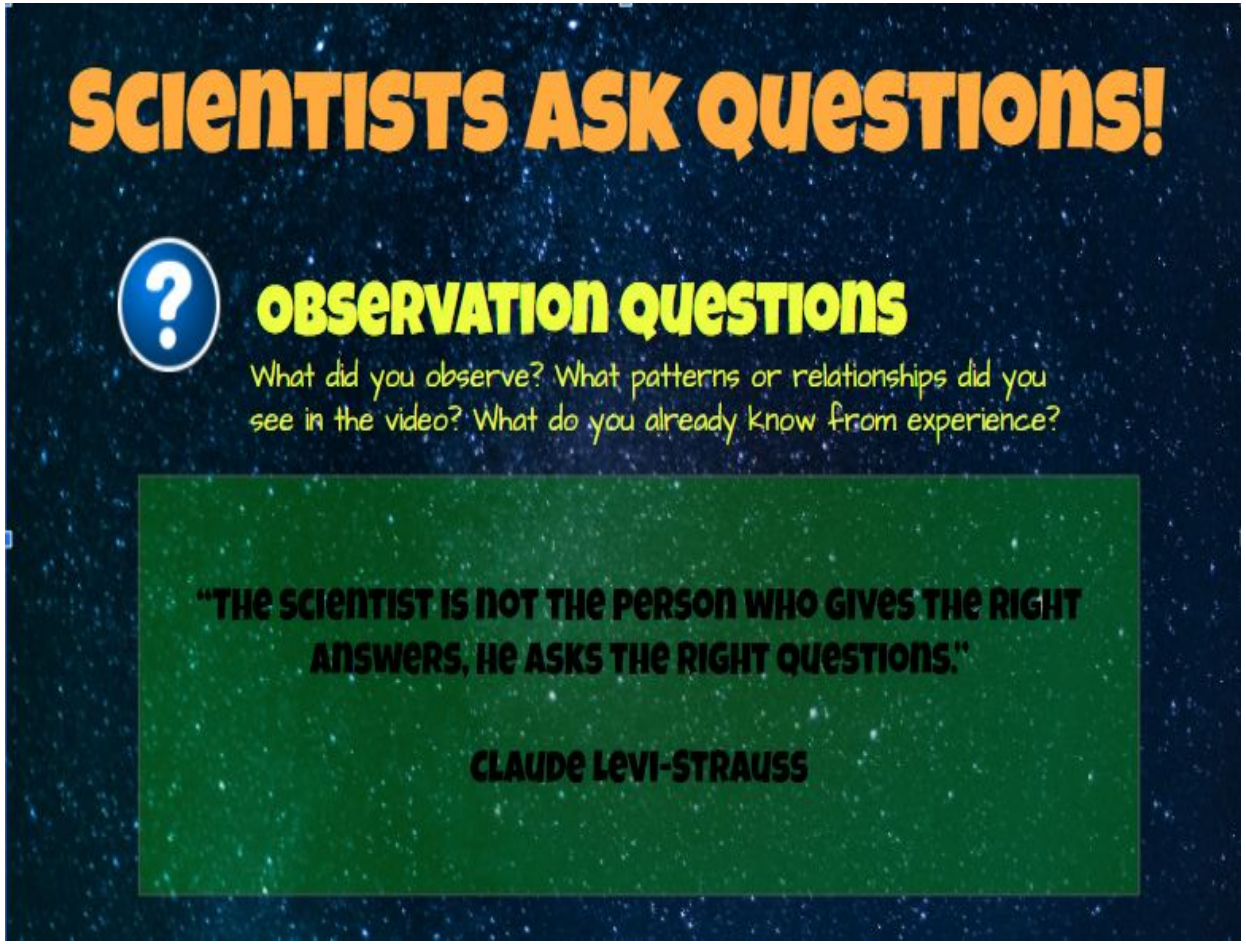
#Going3Dw/GRC Lesson

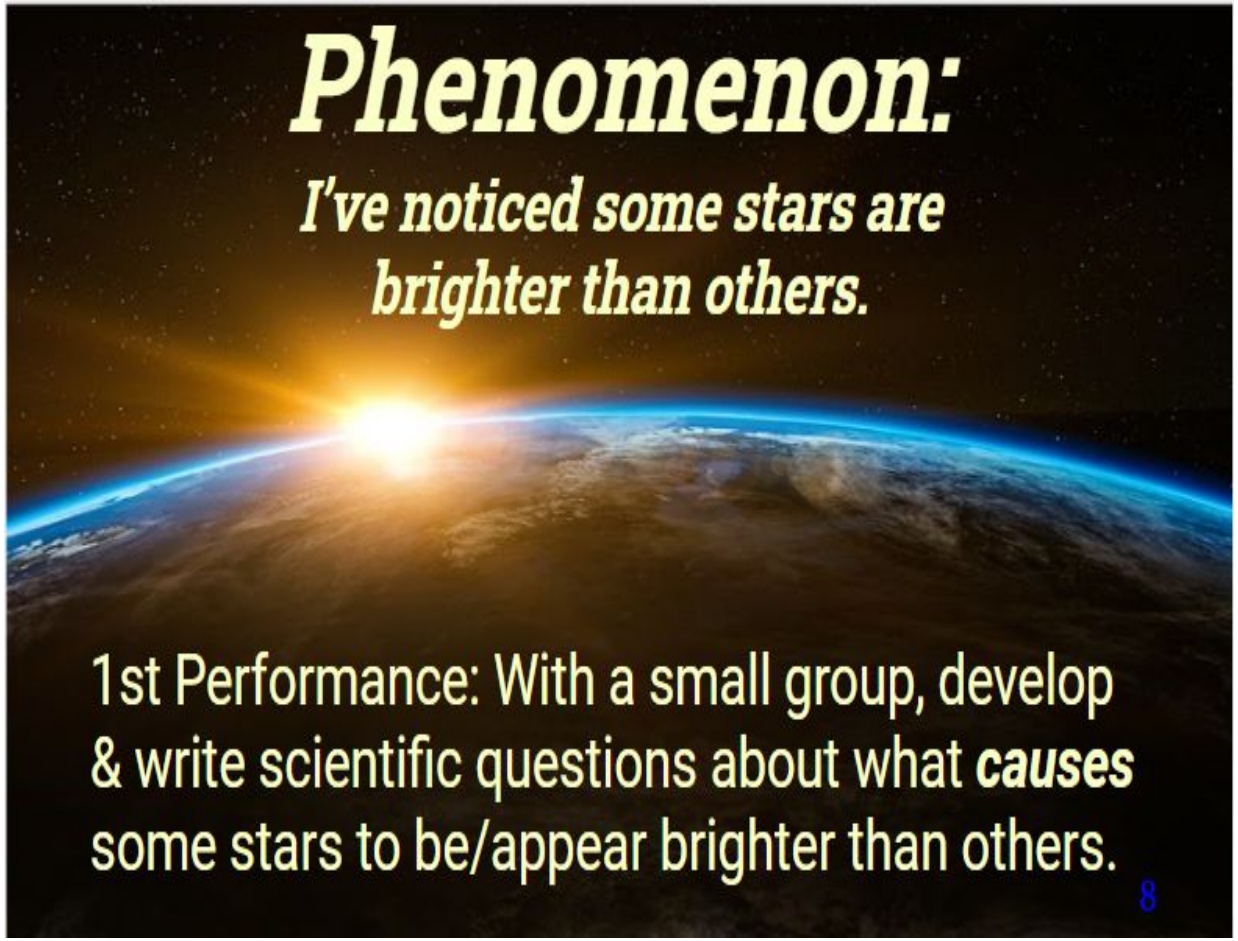


#Going3Dw/GRC Lesson



Gathering


SCIENTISTS ASK QUESTIONS!
OBSERVATION QUESTIONS
What did you observe? What patterns or relationships did you see in the video? What do you already know from experience?
"THE SCIENTIST IS NOT THE PERSON WHO GIVES THE RIGHT ANSWERS, HE ASKS THE RIGHT QUESTIONS."
CLAUDE LEVI-STRAUSS


Phenomenon:
I've noticed some stars are brighter than others.
1st Performance: With a small group, develop & write scientific questions about what causes some stars to be/appear brighter than others.
8

Gathering

GROUP 1
NAMES:

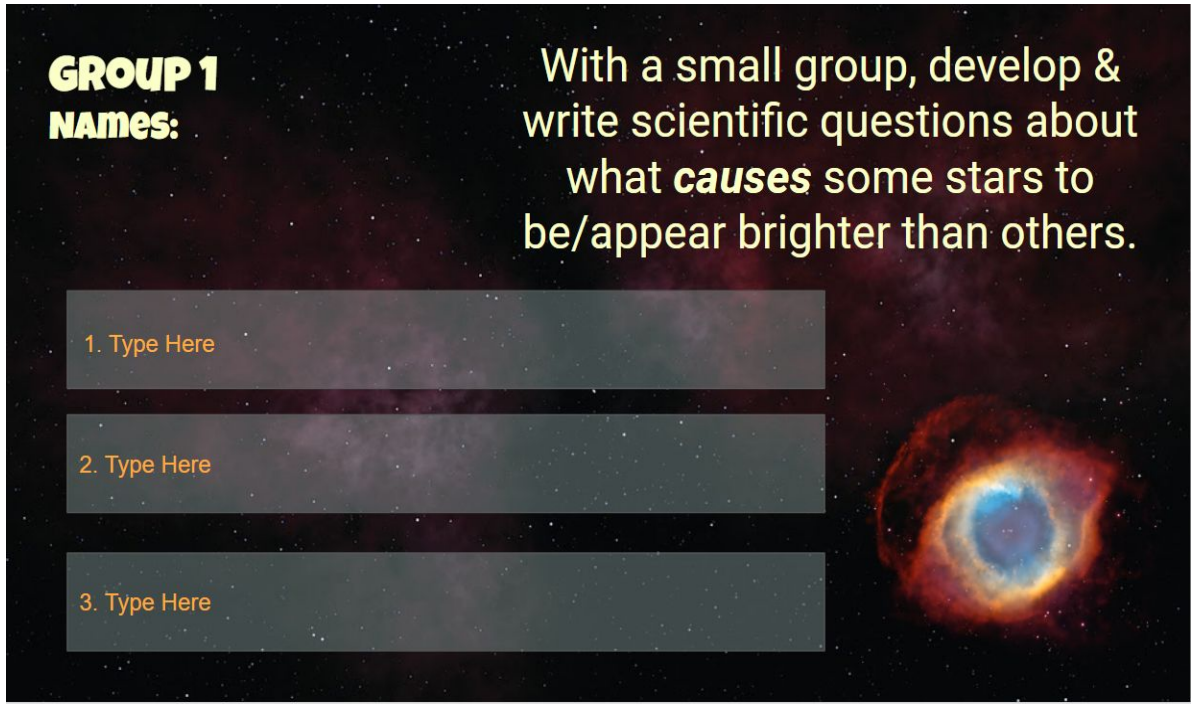
With a small group, develop & write scientific questions about what ***causes*** some stars to be/appear brighter than others.

1. Type Here

2. Type Here

3. Type Here

Gathering



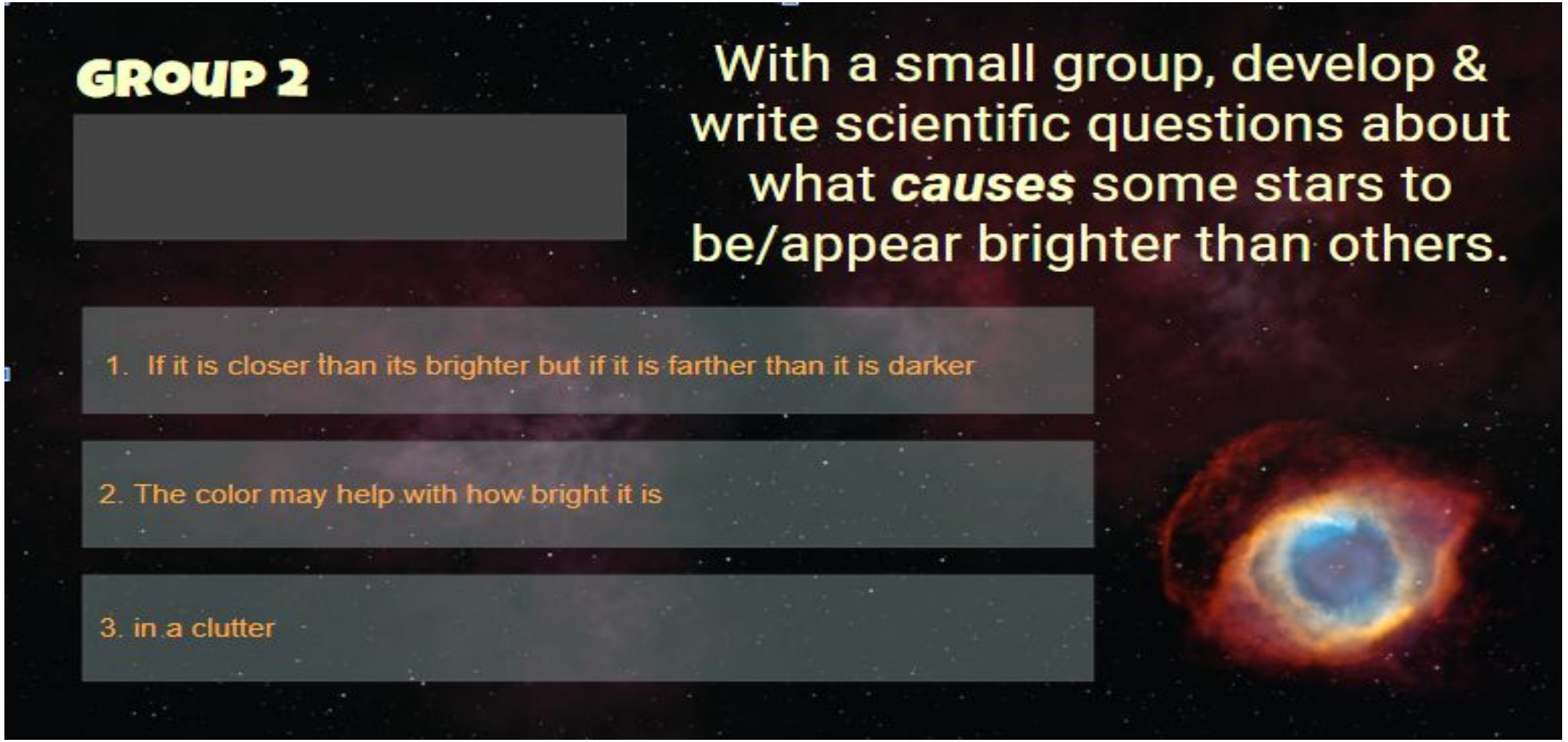
As a group, you will gather information together regarding what you know about what **causes** some stars to be/appear brighter than others.

Please elect someone in your group to record and another person to share.

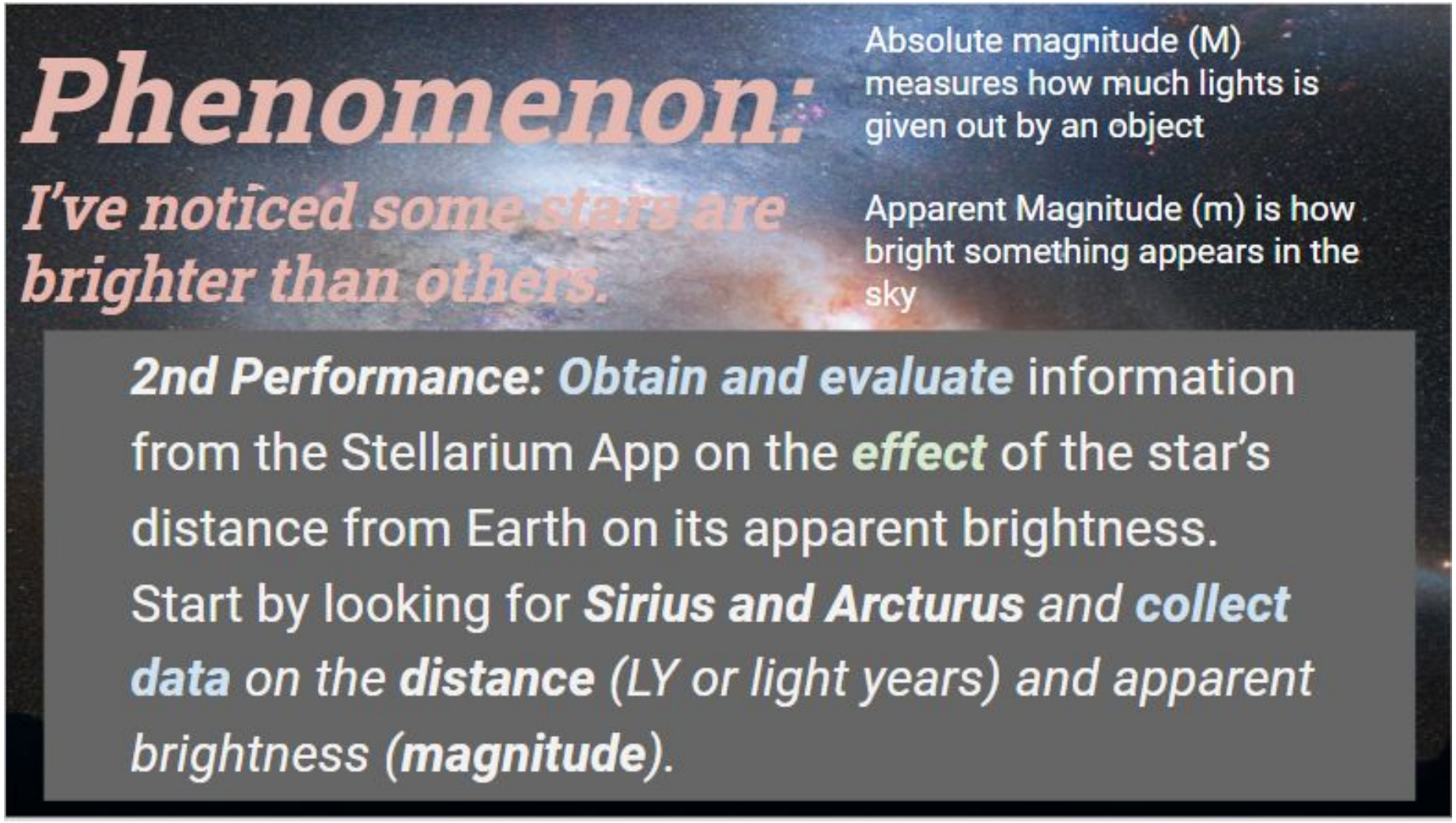
#5 in Dashboard

5	Links for 1st Breakout Room- Gathering	⊕ Breakout Room Google Slides- Gathering

Gathering


GROUP 2
With a small group, develop & write scientific questions about what *causes* some stars to be/appear brighter than others.
1. If it is closer than its brighter but if it is farther than it is darker
2. The color may help with how bright it is
3. in a clutter

Obtaining and Evaluating Information

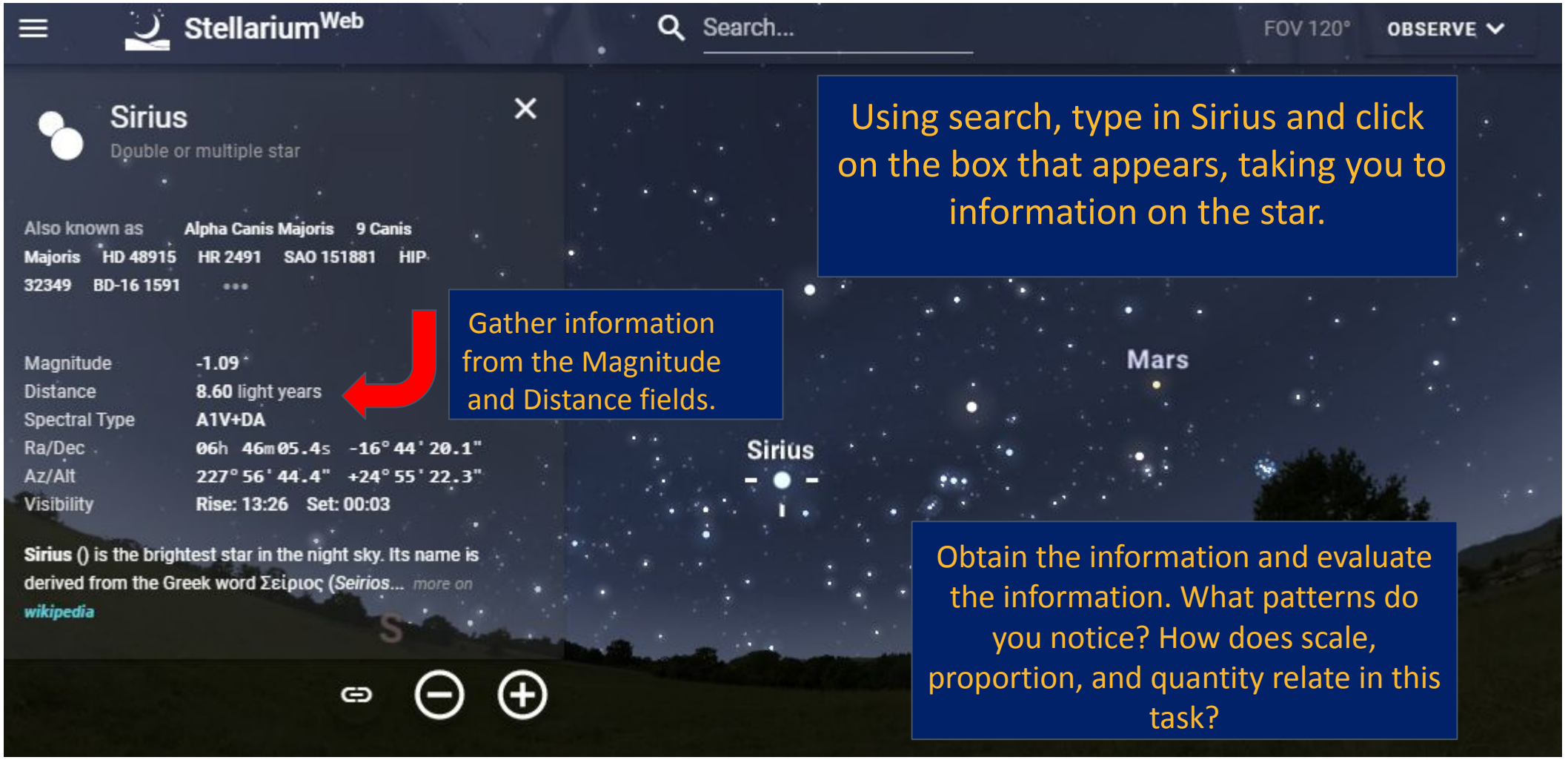


Stellarium

#6 in Dashboard

Click on “Try the Web Version” to access the open source planetarium.

Stellarium

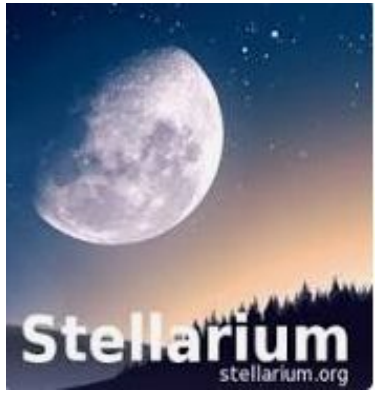

StellariumWeb
Search...
FOV 120°
OBSERVE
Sirius
Double or multiple star
Also known as Alpha Canis Majoris 9 Canis Majoris HD 48915 HR 2491 SAO 151881 HIP 32349 BD-16 1591
Magnitude -1.09
Distance 8.60 light years
Spectral Type A1V+DA
Ra/Dec 06h 46m05.4s -16° 44' 20.1"
Az/Alt 227° 56' 44.4" +24° 55' 22.3"
Visibility Rise: 13:26 Set: 00:03
Sirius () is the brightest star in the night sky. Its name is derived from the Greek word Σειριος (Seirios... more on wikipedia
Mars
Sirius
Using search, type in Sirius and click on the box that appears, taking you to information on the star.
Gather information from the Magnitude and Distance fields.
Obtain the information and evaluate the information. What patterns do you notice? How does scale, proportion, and quantity relate in this task?

Obtaining and Evaluating Information

As a group, you will **obtain and evaluate** information from the Stellarium App or website on the **effect** of the star's distance from Earth and it's apparent brightness.

Please elect someone in your group to record and another person to share.

Start by looking for ***Sirius and Arcturus*** *and* ***collect data*** *on the* ***distance*** *(LY or light years) and apparent brightness (****magnitude****).*



Obtaining and Evaluating Information

Hawaiian Name/ Star Name	Distance (LY)	Magnitude (m)
Kapahi (Aldebaran)	Type Here	Type Here
Hōkūlei (Capella)	Type Here	Type Here
Puana (Procyon)	Type Here	Type Here
Puanakau (Rigel)	Type Here	Type Here
Aʻā (Sirius)	Type Here	Type Here
Kauluakoko (Betelgeuse)	Type Here	Type Here

As a group, you will gather information together regarding what you know about what **causes** some stars to be/appear brighter than others.

Please elect someone in your group to record and another person to share.

#7 in Dashboard

7	Links for 2nd Breakout Room- Obtaining and Evaluating Information	⊕ Breakout Room Google Slides- Obtaining & Evaluating Information

Obtaining and Evaluating Information

Use the Stellarium to find out why each compass hoku appears so bright. (Group 3)

Hawaiian Name/ Star Name	Distance (LY)	Magnitude (m)
Lehua Kona (Antares)	553.75	0.91
Hōkūpa'a (Polaris)	432.57	2.02
Hōkūmau (Pherkad)	486.80	3.00
Hōkūle'a (Arcturus)	36.72	-0.05
Hikianalia (Spica)	249.74	0.97
Regulus (in Leo)	79.30	1.40

Use the Stellarium to find out why each compass hoku appears so bright. (Group 2)

Hawaiian Name/ Star Name	Distance (LY)	Magnitude (m)
Kapahi (Aldebaran)	66.64	0.86
Hōkūlei (Capella)	42.80	0.08
Puana (Procyon)	11.46	0.37
Puanakau (Rigel)	862.85	0.13
Aā (Sirius)	8.60	-1.46
Kauluakoko (Betelgeuse)	497.95	0.42

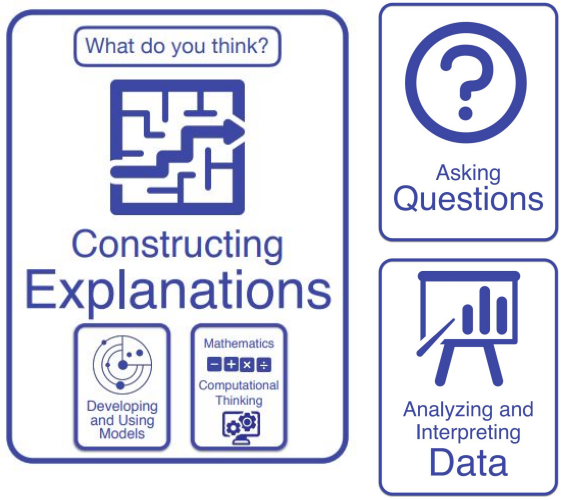
What did we learn from the data?

Think about the information that you and your group obtained and evaluated from Stellarium.

1. The pattern I notice is _____ because _____.
2. I can use this pattern in an explanation by _____.
3. From this pattern _____ I predict that _____ because _____.
4. In this science idea scale is important because _____.

What do we know from the data we collected? What does this all mean?

Science & Engineering Practice(s)



Crosscutting Concepts

#8 in Dashboard

Modeling


Phenomenon:
I've noticed some stars are brighter than others.
3rd Performance: With your group, develop a model to show how the scale of the distance to stars affect the apparent brightness.
2

Modeling

Group 1:
https://docs.google.com/drawings/d/1fJjm_co5qIWAu7t_gGVPbirOXAUlvp2WbF1pw3Tz1ZA/edit?usp=sharing

Group 2:
https://docs.google.com/drawings/d/1wuHa0SJqkF5KdcZlx3M7ttydzwh5mu3QVGXx9nnQp1U/edit?usp=sharing

Group 3:
https://docs.google.com/drawings/d/143DEiMJl5UjLj1zN509MihB9FF4axfC5QoDzcWu_3Ow/edit?usp=sharing

Group 4:
https://docs.google.com/drawings/d/1xB2_OmjQXiAXMBsuTDLCJGSuVH9Q84jf7ZD7CcF5Un0/edit?usp=sharing

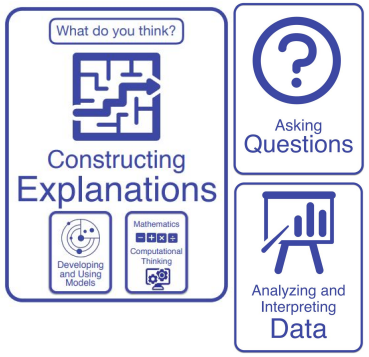
Group 5:
https://docs.google.com/drawings/d/12gC8pLSbVwS1JtTRYgdVRl1cF98696xEgk3z0-Qs0VU/edit?usp=sharing

Group 6:
https://docs.google.com/drawings/d/1c5MKuAbK_FSpKZIX1tV49QDWoxmSv7epF_cNkEL9ovI/edit?usp=sharing

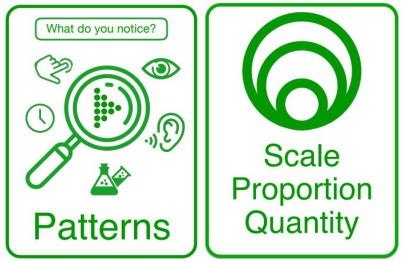
As a group, you will **develop a model** to show how the **scale** of the distance to stars **affect** the apparent brightness.

Please elect someone in your group to record and another person to share.

Science & Engineering Practice(s)

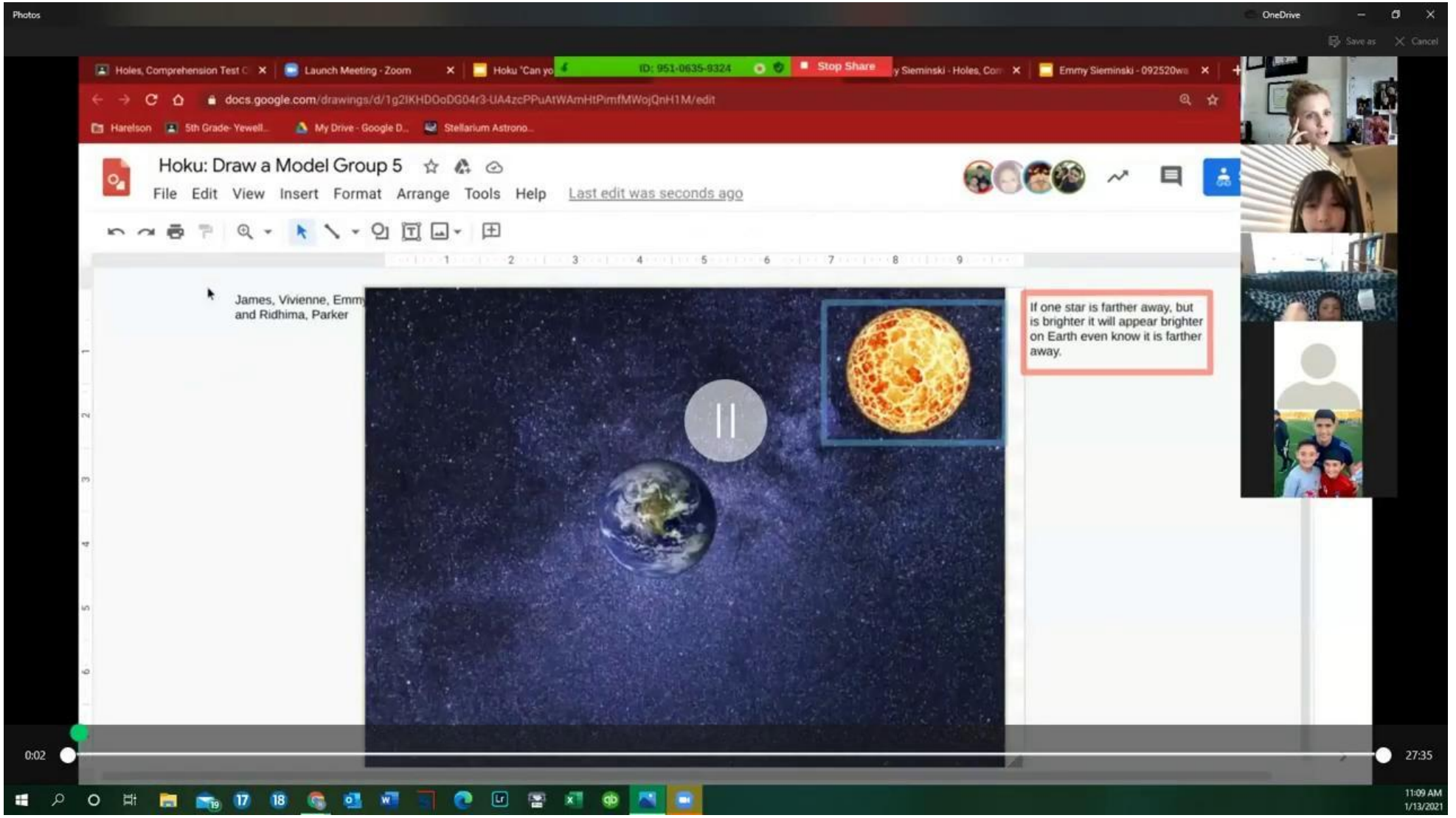


Crosscutting Concepts



#9 in Dashboard

#Going3Dw/GRC Lesson

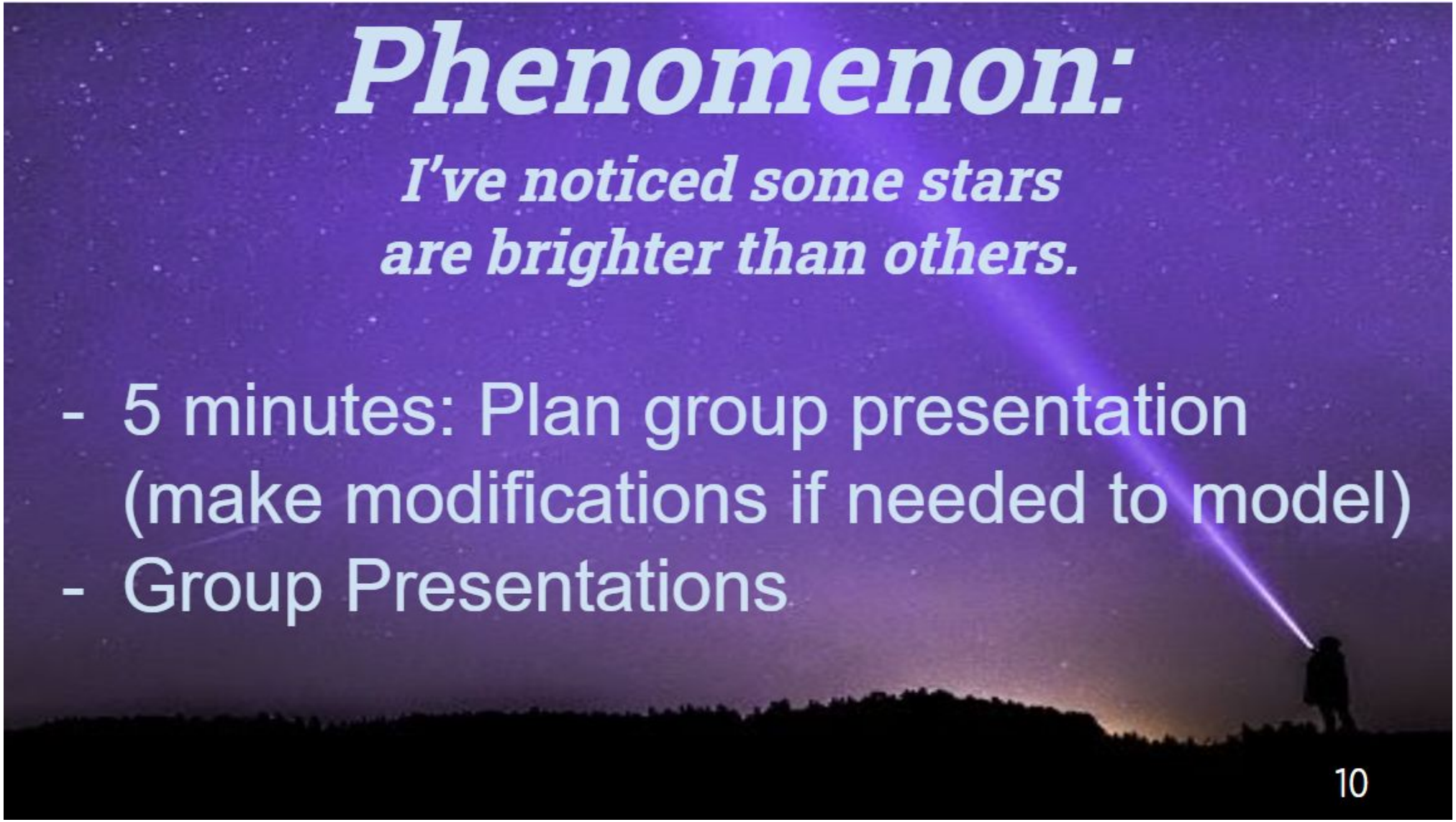


#10 in Dashboard

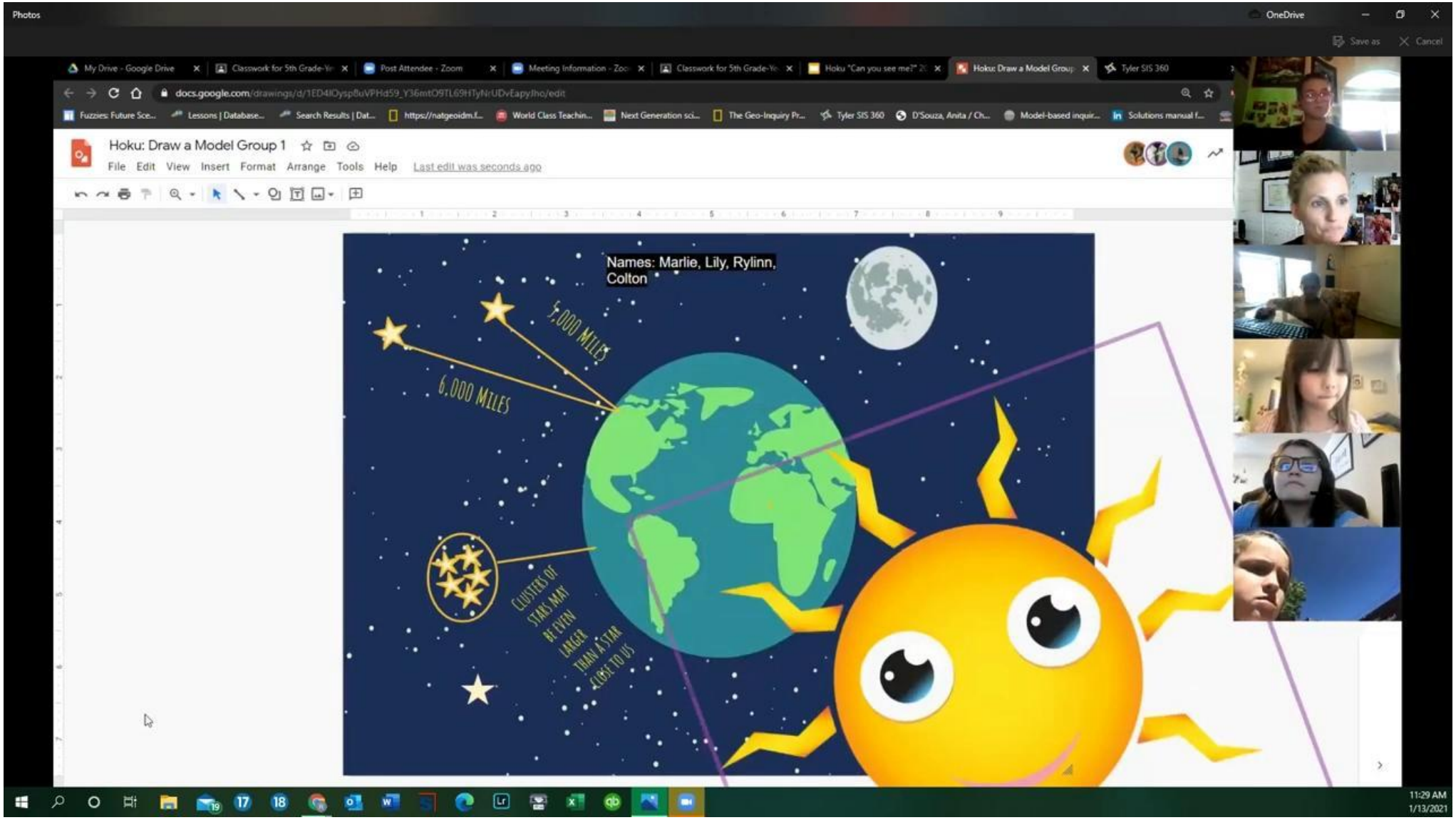
Reasoning

Phenomenon:

Reasoning


Phenomenon:
I've noticed some stars are brighter than others.
- 5 minutes: Plan group presentation (make modifications if needed to model)
- Group Presentations
10

Reasoning

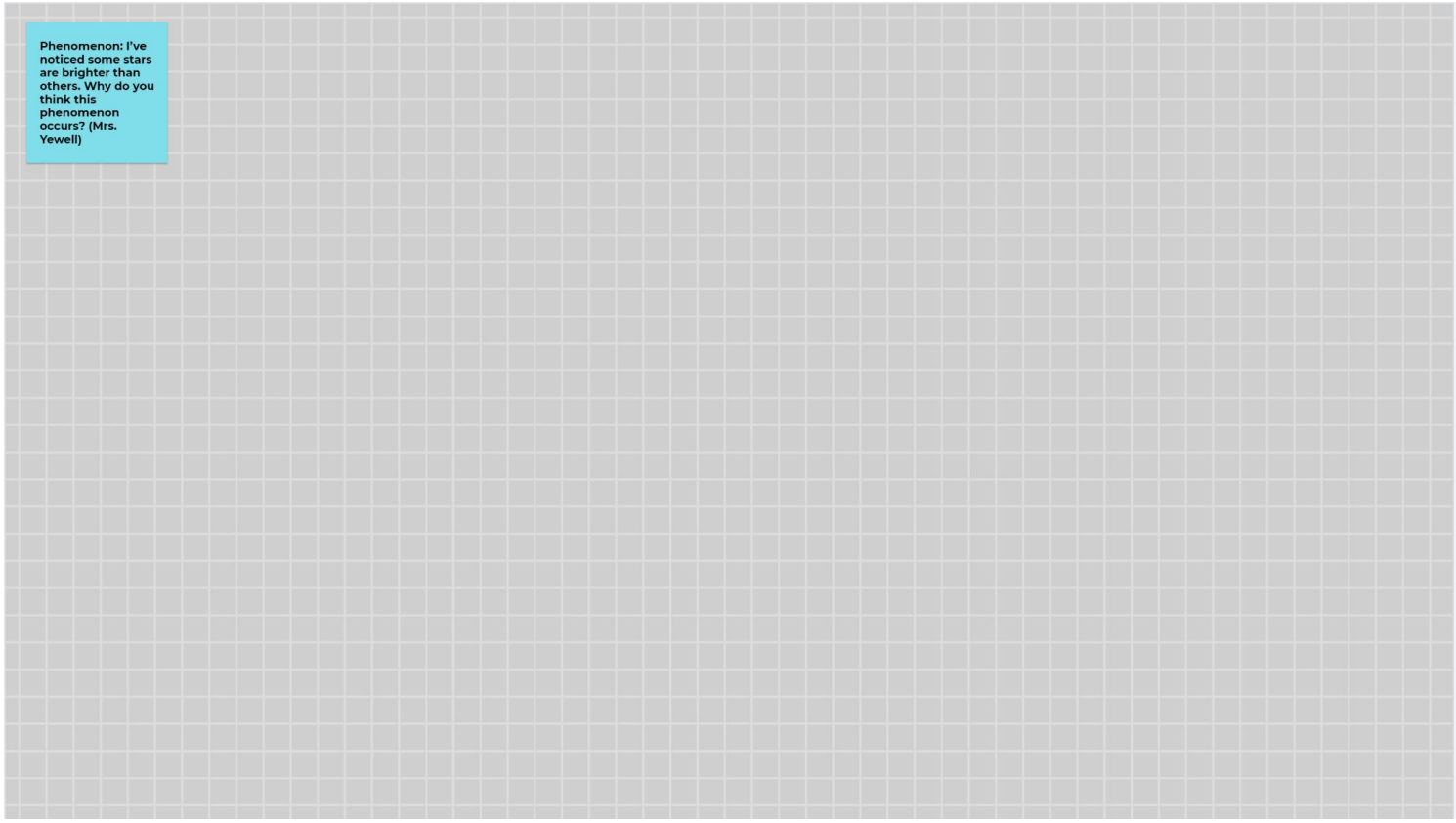

Photos
OneDrive
Save as
Cancel
Hoku: Draw a Model Group 1
File Edit View Insert Format Arrange Tools Help Last edit was seconds ago
Names: Marlie, Lily, Rylinn, Colton
5,000 MILES
6,000 MILES
CLUSTERS OF STARS MAY BE EVEN LARGER THAN A STAR CLOSE TO US
11:29 AM
1/13/2021

Reasoning


Phenomenon:
I've noticed some stars are brighter than others.
CLASS DISCUSSION
(CREATE AT LEAST 2 POST-IT NOTES) GOOGLE JAM BOARD:
HTTPS://TINYURL.COM/YXNKMZH4
3

Reasoning

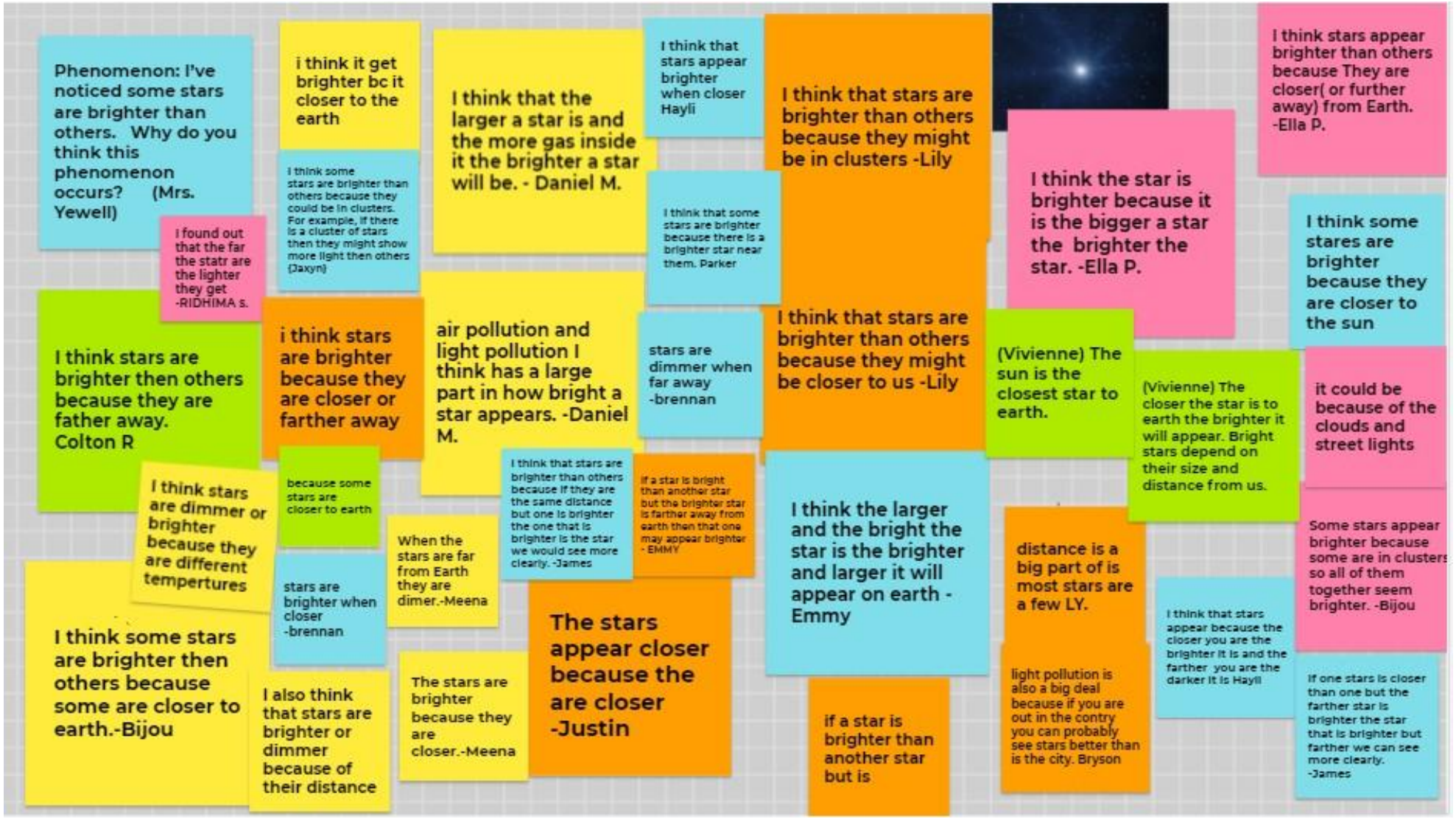
Google Jamboard



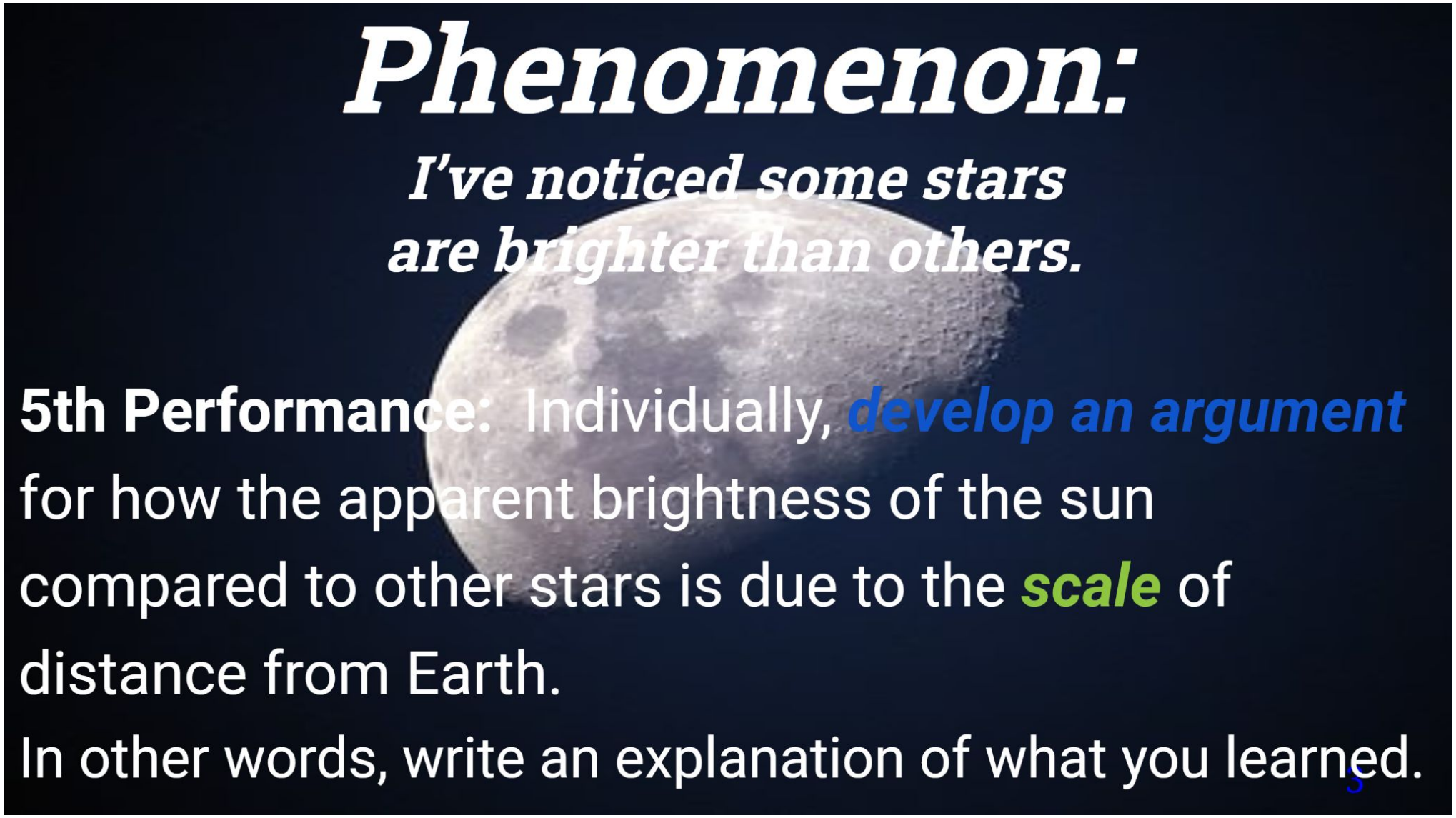
#12 in Dashboard

12	Jamboard for Reasoning	Jamboard Link

Reasoning


Phenomenon: I've noticed some stars are brighter than others. Why do you think this phenomenon occurs? (Mrs. Yewell)
i think it get brighter bc it closer to the earth
I think that the larger a star is and the more gas inside it the brighter a star will be. - Daniel M.
I think that stars appear brighter when closer Hayli
I think that stars are brighter than others because they might be in clusters -Lily
I think the star is brighter because it is the bigger a star the brighter the star. -Ella P.
I think stars appear brighter than others because They are closer(or further away) from Earth. -Ella P.
I think some stars are brighter than others because they could be in clusters. For example, if there is a cluster of stars then they might show more light then others (Jaxyn)
I think that some stars are brighter because there is a brighter star near them. Parker
I found out that the far the statr are the lighter they get -RIDHIMA s.
I think some stares are brighter because they are closer to the sun
I think stars are brighter then others because they are father away. Colton R
i think stars are brighter because they are closer or farther away
air pollution and light pollution I think has a large part in how bright a star appears. -Daniel M.
stars are dimmer when far away -brennan
I think that stars are brighter than others because they might be closer to us -Lily
(Vivienne) The sun is the closest star to earth.
(Vivienne) The closer the star is to earth the brighter it will appear. Bright stars depend on their size and distance from us.
it could be because of the clouds and street lights
I think stars are dimmer or brighter because they are different tempertures
because some stars are closer to earth
I think that stars are brighter than others because if they are the same distance but one is brighter the one that is brighter is the star we would see more clearly. -James
if a star is bright than another star but the brighter star is farther away from earth then that one may appear brighter - EMMY
I think the larger and the bright the star is the brighter and larger it will appear on earth - Emmy
distance is a big part of is most stars are a few LY.
Some stars appear brighter because some are in clusters so all of them together seem brighter. -Bijou
When the stars are far from Earth they are dimer.-Meena
stars are brighter when closer -brennan
I think some stars are brighter then others because some are closer to earth.-Bijou
I also think that stars are brighter or dimmer because of their distance
The stars are brighter because they are closer.-Meena
The stars appear closer because the are closer -Justin
if a star is brighter than another star but is
light pollution is also a big deal because if you are out in the contry you can probably see stars better than is the city. Bryson
I think that stars appear because the closer you are the brighter it is and the farther you are the darker it is Hayli
If one stars is closer than one but the farther star is brighter the star that is brighter but farther we can see more clearly. -James

Communicating



5th Performance: Individually, ***develop an argument*** for how the apparent brightness of the sun compared to other stars is due to the ***scale*** of distance from Earth.

In other words, write an explanation of what you learned.

#Going3Dw/GRC Lesson

Formative Assessment for Student Learning		
Elicit Evidence of Learning: Students ***develop an argument*** for how the evidence collected supports the group's explanation that differences in the apparent brightness of the sun compared to other stars is due to differences in the ***scale*** of distances Earth to the star compared to the sun.		
Evidence of Student Proficiency	**Range of Typical Student Responses**	**Acting on Evidence of Learning**
The sun is a star that appears larger and brighter than other stars because it is closer to Earth. Stars range greatly in their size and distance from Earth. Students develop an argument that supports the explanation that the apparent brightness of the sun compared to other stars is due to the scale of the distance from Earth. The explanation is supported by evidence from the distance calculations of other stars.	***Full Understanding****-Students convey that proportions are used to calculate distances to astronomical objects. Stars range greatly in their distance from Earth. The greater the stars distance from Earth, the longer it takes for light to reach Earth.* ***Partial Understanding****- The differences in a star's brightness is because of its distance to Earth. Some stars are a greater distance from Earth.* ***Limited understanding****- Brighter stars are closer to Earth. Because these stars are so close to Earth, their temperature is warmer.*	*Action for students that exhibit partial or limited understanding can include readings on the astronomical unit or light year. Small group discussion questions focus on scale and proportion.* *Students that exhibit full understanding can research formulas for magnitude and apply to brightness and/or distance from Earth. Discuss patterns in data sets students compile.*

What about the Science & Engineering Practices?

Find and open this resource

#13 in Dashboard

Vertical Progressions Document

K-12 Science and Engineering Practices* Progression Matrix of Elements

For use with *Arizona Science Standards*

Science and Engineering Practices	K–2 Condensed Practices	3–5 Condensed Practices	6–8 Condensed Practices	9–12 Condensed Practices
Developing and Using Models A practice of both science and engineering is to use and construct models as helpful tools for representing ideas and explanations. These tools include diagrams, drawings, physical replicas, mathematical representations, analogies, and computer simulations. Modeling tools are used to develop questions, predictions and explanations; analyze and identify flaws in systems; and communicate ideas. Models are used to build and revise scientific explanations and proposed engineered systems. Measurements and observations are used to revise models and designs.	Modeling in K–2 builds on prior experiences and progresses to include identifying, using, and developing models that represent concrete events or design solutions. - Distinguish between a model and the actual object, process, and/or events the model represents. - Compare models to identify common features and differences. - Develop and/or use models (i.e., diagrams, drawings, physical replicas, dioramas, dramatizations, or storyboards) that represent amounts, relationships, relative scales (bigger, smaller), and/or patterns in the natural and designed worlds. - Develop a simple model that represents a proposed object or tool.	Modeling in 3–5 builds on K–2 models and progresses to building and revising simple models and using models to represent events and design solutions. - Develop and revise models collaboratively to measure and explain frequent and regular events. - Develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution. - Use simple models to describe or support explanations for phenomena and test cause and effect relationships or interactions concerning the functioning of a natural or designed system. - Identify limitations of models. - Develop a diagram or simple physical prototype to convey a proposed object, tool or process. - Use a simple model to test cause and effect relationships concerning the functioning of a proposed object, tool or process.	Modeling in 6–8 builds on K–5 and progresses to developing, using, and revising models to support explanations, describe, test, and predict more abstract phenomena and design systems. - Use and/or develop models to predict, describe, support explanations, and/or collect data to test ideas about phenomena in natural or designed systems, including those representing inputs and outputs, and those at unobservable scales. - Develop models to describe unobservable mechanisms. - Modify models—based on their limitations—to increase detail or clarity, or to explore what will happen if a component is changed. - Use and develop models of simple systems with uncertain and less predictable factors. - Develop a model that allows for manipulation and testing of a proposed object, tool, process or system. - Evaluate limitations of a model for a proposed object or tool.	Modeling in 9–12 builds on K–8 and progresses to using, synthesizing, and developing models to predict and explain relationships between systems and their components in the natural and designed world. - Use multiple types of models to represent and support explanations of phenomena, and move flexibly between model types based on merits and limitations. - Develop, revise, and use models to predict and support explanations of relationships between systems or between components of a system. - Use models (including mathematical and computational) to generate data to support explanations and predict phenomena, analyze systems, and solve problems. - Design a test of a model to ascertain its reliability. - Develop a complex model that allows for manipulation and testing of a proposed process or system. - Evaluate merits and limitations of two different models of the same proposed tool, process, or system in order to select or revise a model that best fits the evidence or design criteria.

SEP: Developing and Using Models

Elements:

Specific pieces of knowledge and skill that make up the practice at each grade band.

K-12 Science and Engineering Practices* Progression Matrix of Elements

For use with *Arizona Science Standards*

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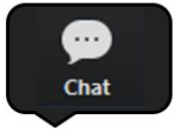
Increasing sophistication →

Developing & Using Models

Which element of the Developing & Using Models science and engineering practice did we engage with?



K–2 Condensed Practices	3–5 Condensed Practices	6–8 Condensed Practices
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A

B

C

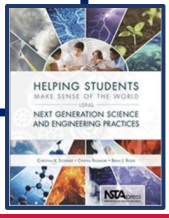
Arizona Department of Education

What the Modeling Practice is *NOT*

NOT art projects that merely translate a two-dimensional image into a three-dimensional depiction or words into a drawing

NOT representations that only ask students to identify the parts of a system. These are not models unless they also depict relationships between the parts and can be used in an explanatory context.

NOT students using a computer simulation to gather information without paying attention to underlying mechanisms-for example-tracking what conditions plants need to grow (light vs. no light, soil vs. no soil) or using a food web simulation that just shows who eats whom.



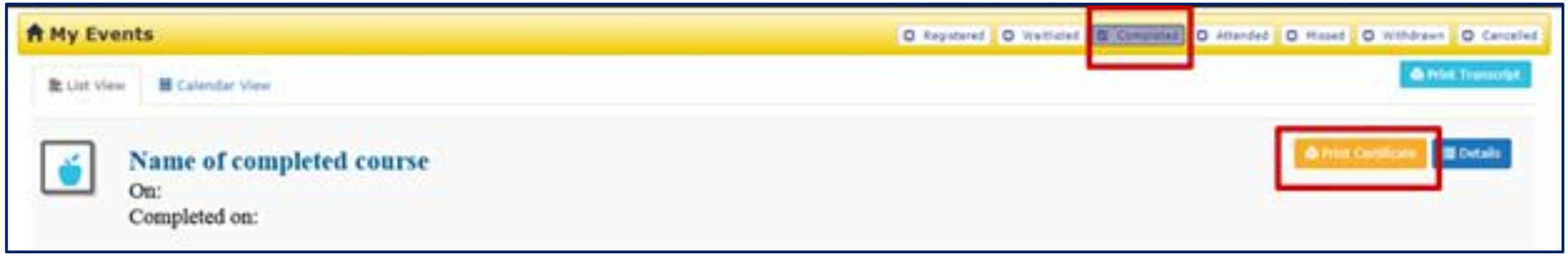
Arizona Department of Education

REMINDER!

Please review this information while we wait for all to join!

Attendance, Resources & PD Clock Hours

- **You must stay on the whole time- 1.5 hours- to receive credit**
- **<u>YOU</u> print your certificate through ADE Connect (see image)- please wait 24-48 hours of webinar before printing certificates**



- **AFTER WEBINAR- Survey & follow-up email from ADE**

Thank you for sharing this space with us!

What questions do you have?

Use a strategy called “stack”- helps build a virtual “line” or stack

Rebecca Garelli I Rebecca.Garelli@azed.gov