

Facilitation Guide Educational Service District 123 and Pacific Northwest National Laboratory Exploring Climate Science with Virtual Reality Follow-up #1 Models and Explanations Ambitious Science Teaching Continued Phenomena and Eliciting Student Ideas		
	 Exploring Climate Science with Virtual Reality Follow-up #2 <i>Teacher/Scientist Partnership</i> PNNL Campus – Mural Room BSF/CSF November 6, 2018 <i>Georgia Boatman, Regional Science Coordinator, ESD 123</i> <i>Peggy Willcuts, Sr. STEM Education Consultant, PNNL</i>  	Slide 1
Slide 2	Welcome Back! • Remember where restrooms and refreshments are. • Be sure to sign the SIGN IN sheet. • Use your table boxes at will and as needed. • Be sure to complete your travel and timesheet before you leave today.	Slides 1-2 10 minutes
Slide 3	Focus Group Sharing Let's take a few minutes to share what we are doing and reflect upon our learning. 	Slide 3: 20 minutes Possible starter or follow-up questions • What was the most important thing you learned at this workshop last time? • What aspects of your new learning will you try with your students? OR • Did you apply your new knowledge and skills in your classroom? If so, how did it go? If not, why not? • How has this work impacted students? OR • How do you think your students will react if you take this back to your classroom?



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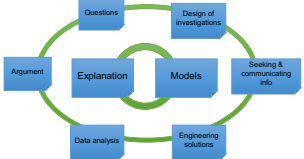
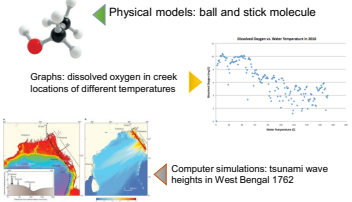
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Slide 4	Lifted  Watch the video of Erik Roner. Question: How is Erik Roner able to successfully fly and safely land using helium balloons attached to a lawn chair? Directions: • Draw your initial model of what is happening that you can't see that causes Erik to move at each point in time. Use dotted arrows to show motion and solid arrows to show forces in the picture. • Draw and label all of the forces acting on Erik. • Write an explanation about what is happening at each point in time.	Slide 4: 25 minutes Handout Secondary Models Document Play the 4+ minute video (linked on picture) with the question in mind and the understanding that you will be drawing an initial model.
Slide 5	Modeling + Explanation are "Keystone" Science Practices  Models either motivate the other science practices (like asking questions, deciding what to test via investigations), or they change as a result of other science practices (data analysis, argument)—and they are tightly coupled with explanations.	Slides 5-11: 5-7 min Last time we worked on argument from evidence. That a step toward constructing explanations. Models are an important thing we can do to construct those explanations around phenomena in CS or anything else. Models and Explanations are at the heart of and the keystone for the other practices. Those practices contribute to the construction of a thorough or gapless explanation.
Slide 6	What are scientific models? Representations of things, ideas, events, or processes (they show relationships)  Physical models: ball and stick molecule Graphs: dissolved oxygen in creek locations of different temperatures Computer simulations: tsunami wave heights in West Bengal 1762	Slides 5-11: 5-7 min You can make use of models when you do CER and definitely they are an important part of moving toward that explanation of a phenomena. A model might be an actual physical model but it need not be and often that is not the most useful model. Data on a graph can model something like temperature in different locations much better than a diagram or physical model Simulations are manipulatable models.



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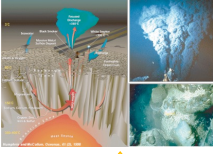
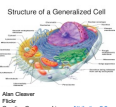
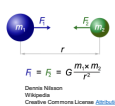
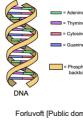
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Slide 7	How Scientists Use Models Scientists use models to advance knowledge - To allow a community to visualize a tentative explanation in order to improve it - To recognize what they might experiment with in order to test a part of the model - To predict how a system will act under certain conditions  Model of hydrothermal vents on the ocean floor	Slides 5-11: 5-7 min Scientists use models all the time. They can be that “back of the napkin” thinking as we construct our understanding they can be a way of thinking through their planning about what they might investigate or experiment with They can be use for predicting outcomes based on conditions They can help us explore things that are too small or too large to manipulate or see the system well
Slide 8	Models used differently by scientists and teachers Models used in classrooms often as static representations of “finished science” To illustrate a concept to students “Here are the parts of the cell”  Alton Clarke Public Creative Commons License Attribution 2.0 To show how something works “Here is how forces interact”  Demetri Nikolov Wikimedia Creative Commons License Attribution 3.0	Slides 5-11: 5-7 min They can help us explore things that are too small or too large to manipulate or see the system well
Slide 9	What is modeling? A scientific practice, in which representations of phenomena are created, tested, and revised over time.  Francis Crick  Fortuyn (Public domain) Evolution of DNA double helix model License: Creative Commons Attribution 3.0	Slides 5-11: 5-7 min Look over this slide, what does it show you. Share Rosalind Franklin’s initial ideas actually were the basis for a more evolved understanding of DNA by Watson and Crick



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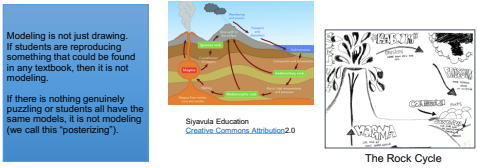
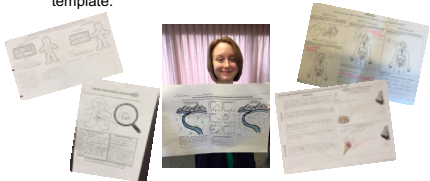
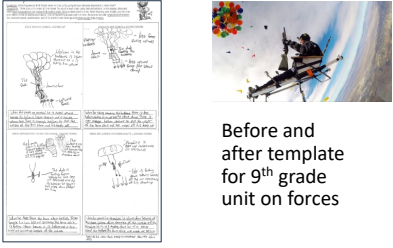
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Slide 10	Avoid creating “posters” 	Slides 5-11: 5-7 min Models are not just drawings. It shouldn't be a copy of existing pictures. Or ‘google-able’ but rather should reflect a students’ thinking about a phenomena or event. It shouldn't be just a poster. Example: If I show you a rock cycle graphic, give you all the components of the rock cycle and then ask you to draw the rock cycle that is not really a model so much as a pictorial way to show your summative learning. But if I asked you to draw and describe ways that rock forms over time that would be more of a model. It is all about the context in which they show their learning. A model is a thinking tool.
Slide 11	Templates You can get students to “show the most of what they know” by adding scaffolds to the final model template. 	Slides 5-11: 5-7 min Scaffolding for students to construct models with gapless explanations can be a really useful way to truly see the evolution of student learning. This could be a valuable formative assessment task in a classroom and is part of the learning and not an add on to daily classroom learning.
Slide 12	 Before and after template for 9th grade unit on forces	Slides 12-18: 20 min. Slides 12-15 10 min. Have partners look at and discuss the initial and final models following slide directions Slides 16-18 10 min. Same process to consider scaffolds



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Slide 13	Initial and Final Models Panel 1 of this student's initial model Panel 1 of this student's final model 1. What is the difference between what this student appears to know early and late? 2. What do you think the model allows students to show about what it is that they know?	Slides 12-18: 20 min. Slides 12-15 10 min. Have partners look at and discuss the initial and final models following slide directions Slides 16-18 10 min. Same process to consider scaffolds
Slide 14	Structured Share & Compare • Listen to your partner share about <u>one</u> idea. • Respond to what you hear. • Clarifying question: Can you tell me/us more about....? • Agreement: I think the same thing, but I would also add... • Disagreement: I don't think we agree because... Why do you think that? • Partner responds to your statement or question. <i>Take turns and share 1 or 2 ideas each.</i>	Slides 12-18: 20 min. Slides 12-15 10 min. Have partners look at and discuss the initial and final models following slide directions Slides 16-18 10 min. Same process to consider scaffolds
Slide 15	Panel 1 of this student's initial model Panel 1 of this student's final model Initial and Final Models Explanations	Slides 12-18: 20 min. Slides 12-15 10 min. Have partners look at and discuss the initial and final models following slide directions Slides 16-18 10 min. Same process to consider scaffolds
Slide 16	Scaffolding • What kinds of scaffolds did the teacher provide for the students on the model template? • If you did not include this kind of scaffolding, would you likely have students showing you this kind of work? What does this scaffolding do to support them?	Slides 12-18: 20 min. Slides 16-18 10 min. Have partners look at and discuss the initial and final models following slide directions Slides 16-18 10 min. Same process to consider scaffolds



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Slide 17	Gotta Have Checklist: Ideas that have to be in the model, or in the explanation, or both Gotta-have checklist: ideas that have to be in the model, or in the explanation, or both.  □ We have presented the question: "How can the re-introduction of sea lion wolves have as great an impact on the Yellowstone ecosystem and environment?" □ We have shown what changed in the Yellowstone ecosystem between 1995 and 2016, including: □ relationships between organisms the area we look native to our story, □ the state of populations the area we look native to our story, □ behavior of organisms, and □ the impact of the ecosystem. □ We have represented how energy is used by organisms and how it moves through the Yellowstone ecosystem. □ We have represented how good balance and competition in some species affects the chances of their survival in Yellowstone. □ In our written explanation, we have used evidence from the summary table or from other resources to support at least three parts of our model. We have said what the evidence is and exactly how it supports our assertions.	Slides 12-18: 20 min. Slides 16-18 10 min. Have partners look at and discuss the initial and final models following slide directions Slides 16-18 10 min. Same process to consider scaffolds Point out the rubric like quality of a “gotta have checklist”
Slide 18	Structured Share & Compare Again  • Listen to your partner share about <u>one</u> idea. • Respond to what you hear. • Clarifying question: Can you tell me/us more about....? • Agreement: I think the same thing, but I would also add... • Disagreement: I don't think we agree because... Why do you think that? • Partner responds to your statement or question. • Take turns and share 1 or 2 ideas each.	Slides 12-18: 20 min. Slides 16-18 10 min. Have partners look at and discuss the initial and final models following slide directions Slides 16-18 10 min. Same process to consider scaffolds
Slide 24	The Planning Flow Engagement:  Eliciting Student Ideas: Supporting Changes to Ongoing Student Thinking: Pressing for Evidence Based Explanations:	Slides 24-25 45-50 min. A brief reminder of where we are in the process Then using the Planning for Engagement tool section 4



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Slide 25	Nose to the Grindstone! Work on Planning for Engagement ● Focus on completing Step 4 for your phenomena  https://commons.wikimedia.org/wiki/File:Grindstone.jpg	Slides 24-25 45-50 min. A brief reminder of where we are in the process Then using the Planning for Engagement tool Step 4 Be prepared to have something in writing that gets uploaded to the folder on Google Drive. Make the case for why a large variety of documents can be helpful to other teachers. We want products to share. A platform will be created by which these products will be shared.
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