**Developing and Using Models**

*Time: 45 minutes*

**Goals:**

* Define and give examples of what it means for students to engage in the science practice of developing and using models
* Engage in developing and using models
* Explore different examples of models that students might develop and use in the science classroom

**Materials:**

* Instructional Strategies handout
* Materials for the modeling activity, which may include:
  + Play-doh or clay
  + White paper, or poster paper
  + Markers, crayons, pencils
  + Flashlights

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| **Activity** | **Description** | **Time** |
| Defining “Developing and Using Models” | * **\*Note:** Before the session, create the following data table on chart paper. Cover the headings for columns 2-5 leaving just the first column (i.e. “Example”) visible at the start of the session.  |  |  |  |  |  | | --- | --- | --- | --- | --- | | Examples | Do students create or use it to describe natural phenomena? | Do students create or use it to explain natural phenomena? | Do students create or use it to predict natural phenomena? | Can students evaluate it for merits and/or limitations? | |  |  |  |  |  | |  |  |  |  |  |  * Ask participants to brainstorm what comes to mind when they hear the word “model,” as it relates to science practices. Remind participants that when brainstorming all contributions are valued. * Record the examples on the chart paper in the first column under “Example.” Participants might bring up examples such as a 3D model of a heart, a diagram of a flower, a computer simulation on the spread of disease, etc. * Once 4-5 examples have been shared and written on the chart paper, share and read the definition of this science practice from sciencepracticesleadership.com   + Encourage participants to think about this definition and how it relates to the examples that they brainstormed. Uncover the headings for the other columns on the chart paper * Go through each of the examples brainstormed, answering the questions in the columns on the chart.   + The purpose of this activity is to convey that a model explains and/or predicts, and that students should be able to evaluate a model.   + A simple drawing of a heart is not a good example of a model in science. If, however, students create or use a heart model in which they can manipulate the opening and closing of a valve in order to the predict what happens when a valve does not close properly, that would be a model as it relates to the scientific practice of modeling. * Explain that during this session they will explore a physical model that students could use to explain day and night, and they will discuss the merits and limitations of this model | 10 min |
| Making Your Own Model Activity | * Have teachers work in groups of 2-3 to create a model that *explains why people on Earth experience day and night* * Inform teachers that their models can take on many different forms, and encourage them to be creative. Hand out various materials for teachers to use to create their models (e.g. play-doh or clay, white paper, crayons, markers, pencils, flashlights) * When everyone is done, have participants share their models with the whole group. * Afterwards, discuss the following questions:   + What are the strengths and limitations of the various models?   + How could developing and using these models help further your students’ understanding of this phenomena beyond simply reading text? | 15 min |
| Exploring Different Types of Models | * Explain to participants that there are many different types of models that students might use in the science classroom to predict or explain natural phenomena.   + Note that models can range from simple to more complex and may require little material to specialized material and/or technology * Examine the sample models. Add each type of model to the chart from the beginning of the session, and answer the questions in the columns of the chart. It should become evident that these sample models align with the definition of this science practice because students can use them to explain or predict the natural world, and they can evaluate the merits and limitationsof each mode * The sample models include:   + Computer simulation model: The Wolf Sheep Predation simulation on NetLogo is explores the stability of predator-prey ecosystems. Note that this link will show you a description of the simulation. If you want to show participants how it actually works you will have to create a free count on NetLogo.     - http://ccl.northwestern.edu/netlogo/models/WolfSheepPredation   + Structural model: The Lego DNA Learning Center sets are models that can be used to explain what molecules are doing inside of cells. If participants want to learn more about these models, show them the brief video:     - <https://www.youtube.com/watch?v=Mv0ldAHQRAI>   + Mathematical model: Review the Ideal Gas Equation, which can be used to explain the behavior of many gases under different conditions     - Review what each of the variables stand for, noting that the units of each variable are not described in the mathematical model * Facilitate a whole group discussion around the following questions:   + In what ways can students predict or explain some phenomenon using these representations?   + When are these representations not used as models?   \**Note: For example, if a teacher shows the DNA structure and just describes the different components to students then it is just a representation. When students use the DNA structure to explain some phenomenon, such as how cells replicate, then the representation becomes a model.* | 10 min |
| Reflection on Current Instruction | * Pass out the Instructional Strategies handout. Have participants read through the handout, reflecting on the extent to which their students currently have opportunities to engage in this science practice in the classroom. * Conduct a think-pair-share around the following questions:   + Do you currently use any of the instructional strategies from this handout in your science classroom? If so, which one? If not, which one would you be interested in using in the future?   + How has your understanding of “developing and using models” in science changed after this session?   + What questions do you still have about this science practice? | 10 min |
| Additional Resources | * Share some ways that teachers can learn more information about “developing and using models”   + Watch the Bozeman video on types of models. This video categorizes types of models in depth:     - <https://www.youtube.com/watch?v=Gn26g5RFXpQ>   + Read a vignette of a 7th grade classroom engaged in this science practice:     - [<http://www.sciencepracticesleadership.com/exemplar---grade-7.html>](http://www.sciencepracticesleadership.com/exemplar---grade-7.html) |  |