Video Transcript

Science and Engineering Practices Part 1

[slide 1] Welcome to DLM Science Module 2: Science and Engineering Practices.

[slide 2] After completing this module, you will be able to identify the science and engineering practice for an Essential Element (EE) and identify how to engage students in the science and engineering practice specified in an EE.

[slide 3] As a review, these are the eight science and engineering practices used in the DLM science EEs. These eight sets, and their subsets, are skills often used by scientists and engineers:

1. Asking questions and defining problems
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 and designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

The asterisk mark after practice 1 indicates that this practice is not currently assessed.

[slide 4]This section provides an overview of how to use science and engineering practices in DLM Science EEs.

[slide 5] In a previous module, we explored how the science and engineering practices are used in the DLM Science Framework. This module provides more information about the science and engineering practices. Each DLM science EE specifies one science and engineering practice. Testlets contain items that target the science and engineering practice for that EE. Therefore, it is essential to provide experiences for students with these practices. In this module, we will also show how the skills used in science and engineering practices increase in complexity from grades 3 to 12.

[slide 6] Two available resource documents are the DLM Essential Elements for Science and the DLM Adapted Science and Engineering Practices Document. Both are available on the DLM website. Next you will learn how to use these documents.

[slide 7] This is a page from the DLM Essential Elements for Science document. We will use this document to identify the science and engineering practice in an EE. The top four rows describe the domain, core idea, topic, and how the EE aligns with the State Standard for General Education. The three middle rows under Essential Element EE.5-L S2-1 describe the linkage level expectations. The bottom three rows describe how the EE connects to science practices, crosscutting concepts, and other content areas, in this case, ELA.

[slide 8] This is a page from the DLM Adapted Science and Engineering Practices document. Use this document to identify how to engage students in the science and engineering practice that is specified in an EE. The content is adapted from the *Next Generation Science Standards* Appendix F. Breadth, depth, and complexity have been reduced for students with significant cognitive disabilities. This document identifies how science and engineering practices are used at each grade band. This page presents the

science and engineering practice of Developing and Using Models. There is a separate column for each DLM grade band: elementary, middle school, and high school. Each column describes the kinds of models included in that grade band, how models can be used, and what students can be asked to do with models. The rows show how the practice of using models increases in complexity from elementary to high school.

[slide 9] In the next section, we will show how to use these documents together to identify how to engage students in the science and engineering practice in an EE.

The steps include

1. Finding the EE page in the DLM EEs for Science document and identifying the science and engineering practice
2. Finding the practice page in the DLM Adapted Science and Engineering Practices document, then finding the column for the corresponding grade band

[slide 10] In the first example, we will apply this process to an elementary school EE.

[slide 11] This example uses EE.5.LS2-1. In the EE document, you can find the science practice in the section just below the linkage level descriptions. The practice of developing and using models is the science and engineering practice being assessed with this EE. Next, we will show you how to find more specific information about how students engage in the practice of developing and using models.

[slide 12] Let's examine the page for Developing and Using Models in the DLM Adapted Science and Engineering Practices document to find out how elementary students can use this practice. This is an elementary school EE, so we use the "EL" column on the right. We can select the items from the lists in each box that best fit with this EE. This particular EE is about creating models that show the movement of matter through living things, which are usually food chains or food webs. From the "EL" column, we identify items that fit with the EE. For example, in the "models include" box, we see models include drawings and diagrams. In the "models can be used to" box, we see models can be used to represent concrete events or processes, and in the "students can be asked to" box, we see students can be asked to use models to describe phenomena. This information can help a teacher decide what to include in instruction.

[slide 13] In science, most models are conceptual models. A food chain model is a conceptual model that represents one or more parts of a process but does not have to show all the parts of the process. In this model, the arrow represents how material moves from one living thing to another. For example, the arrow pointing from the leaf to the worm represents that a worm gets matter from the leaf.

[slide 14] The DLM Adapted Science and Engineering Practices document shows that models can be used to represent concrete events or processes.

[slide 15] For this EE, students should have opportunities to create models that represent eating relationships for common organisms in common ecosystems. Students should be able to make meaning of simple food chain models that involve common plants and animals.

[slide 16] The next example uses a middle school EE.

[slide 17] This example uses EE.MS.PS2-2. From the EE document, we identify the practice of planning and carrying out investigations. Next, we will find more specific information about how students engage in the practice of planning and carrying out investigations.

[slide 18] Let's examine the page for planning and conducting investigations in the DLM Adapted Science and Engineering Practices document to find out how middle school students can use this practice. For a middle school EE, we can use both the middle school column and the elementary school column because the expectations for middle school students also include the items from the elementary school column. We select items from each box that best fit with the EE. This EE requires students to investigate and predict the changes in the motion of objects. The science and engineering practices can include many components, including identifying goals, planning, controlling variables, producing data, and predicting outcomes. Investigations can be used to support an explanation of how forces affect motion. Finally, students can be asked to evaluate appropriate methods and/or tools for collection, plan and conduct an investigation using fair tests, and identify and produce data that will serve as the basis for evidence.

[slide 19] Remember while the identified EE in this example is at the middle school level, components of the practice in the elementary school column are also expected for middle school students. Skills learned in elementary school that are relevant to the identified middle school EE include carrying out investigations, making observations and measurements, identifying results, answering questions, and conducting simple investigations with guidance.

[slide 20] For the example EE, which requires students to investigate changes in motion based on forces, students can investigate the question, "What kind of push makes a car go the fastest?" In middle school, students are expected to identify components of an investigation that could be changed or tested, identify tools needed to make measurements, how to record measurements, and data that answers the question. Students are expected to make some decisions in how to carry out experiments.

[slide 21] The components of an investigation that can be changed or tested are called variables. The next slide explains how variables are used in fair tests.

[slide 22] This table describes the different kinds of variables that are used in fair tests. An independent variable is the variable that is tested by the student. In this example, the independent variable is the force. Only one independent variable can be tested at a time in an experiment. The dependent variable is the variable that is measured, counted, or observed to decide if altering the independent variable has had an effect. In this experiment, the dependent variables is the speed. Controls are variables that are kept the same throughout the experiment to make it a fair test. If the test is fair we can determine if the independent variable caused a change in the dependent variable. In this example, controls would be the weight of the car. For example, if two different car weights were used in the experiment, we could not tell if the observed change in motion was caused by the force or the weight of the car.

[slide 23] Experiments should have multiple levels or values of the independent variable. For this example, multiple levels of the independent variable can mean different sized force, such as a hard or soft push. In the module quiz, you will practice using the information in the DLM Adapted Science and Engineering Practices document to identify how to engage students in the practice associated with an EE.

[slide 24] Thank you for completing Part 1 of Module 2: Science and Engineering Practices. For more information, go to http://dynamiclearningmaps.org.