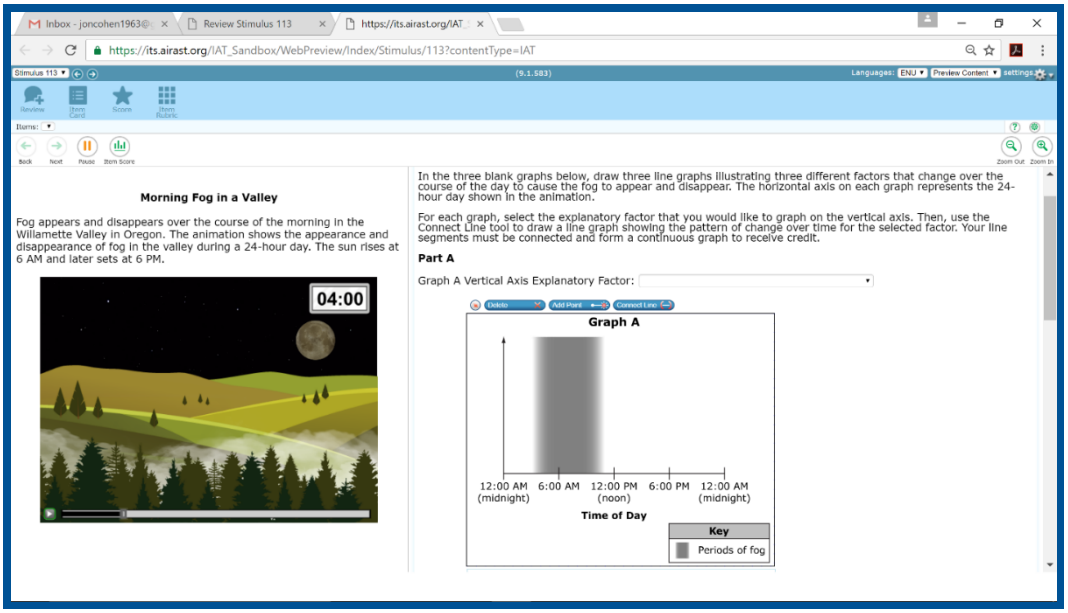
Sample Science Task

We offer a sample item cluster as an example of the clusters that we are building in other states and the capabilities that would be available to the Department under this contract.

Here we present a cluster measuring a middle school level performance expectation related to the cycling of matter and energy in the water cycle. The student will develop a model to explain that solar energy is driving the cycling of water. We begin with a phenomenon: fog regularly forms and then dissipates over the course of a morning in an Oregon valley. The phenomenon is communicated verbally and with an animation, as shown in Exhibit D1.2-27. The introduction and animation appear on the left side of the screen, and the items appear on the right.

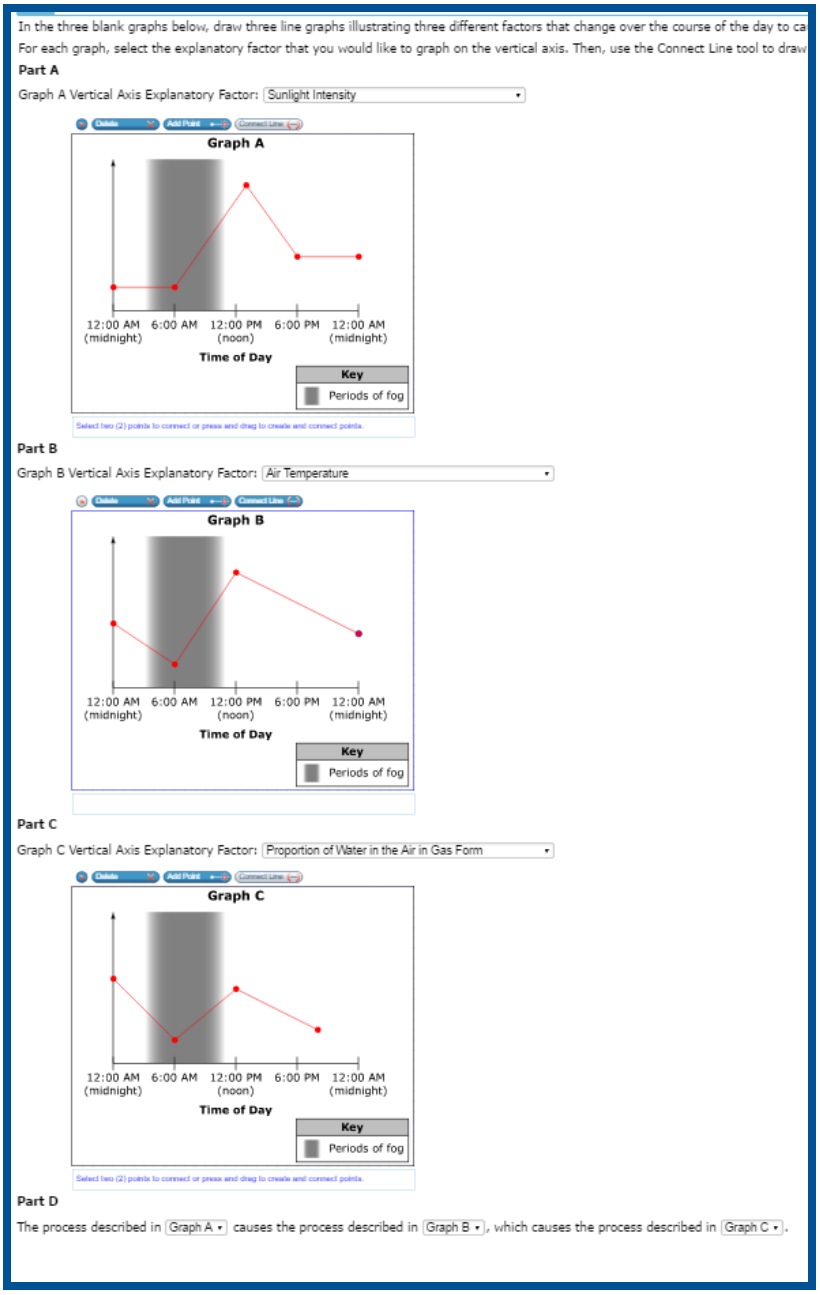
Exhibit D1.2-27: Sample Science Item



In this cluster, the student is asked to develop a mathematical model by identifying and graphing three factors that combine to create the phenomenon. Each empty graph has a 24-hour period on the horizontal axis. The period during which the fog is visible is marked on the graph. Using the drop-down menu, the student selects which factors to graph from a list containing distractors. Each graph is heuristic, rather than requiring specific quantities. Even though the student is asked to graph, the scoring rubric is looking for patterns reflecting conceptual understanding rather than mathematical understanding of the phenomenon.

Exhibit D1.2-28 illustrates one of many (virtually infinite) correct answers. The student should graph the amount of sunlight, the temperature, and the proportion of water in the air that is in a gas form. The final item asks the student to indicate the causal sequence of the fog's formation and dissipation. Note that students can graph the factors in any order, as long as the graphs have the right characteristics (for example, solar energy increasing over the course of the morning as the fog dissipates).

Exhibit D1.2-28: Items and Sample Answer



These interactions are actually a single item, and the scoring depends on the collection of responses rather than any single interaction. Our technology enables a scoring rubric to look across multiple interactions.

Using this approach, we engage students in actual scientific activities—in this case, modeling for the purpose of explanation. The performance expectation calls on students to actually employ a model, and they do that in this cluster. Moreover, they use a model that explains energy and matter transfers within part of the water cycle, thereby weaving in elements of all three dimensions of the performance expectation.

The questions are truly open-ended constructed-response items. *These items are also immediately and accurately machine scored.* Our tools allow our test developers to develop these sophisticated item clusters without requiring the assistance of software developers.

Finally, the features of the student responses that receive credit *and* the inference that the test developer would like to make from that evidence are explicitly captured as part of the item in the scoring assertions. Exhibit D1.2-29 presents the scoring assertions for this response to this item. These scoring assertions embody evidence-centered design as a physical part of the item.

Exhibit D1.2-29: Scoring Assertions for Fog Cluster