

CORPS

Central Oklahoma Rural Partnership For Science

A GUIDE TO USING A PHENOMENON-DRIVEN
THREE-DIMENSIONAL INSTRUCTIONAL SET



The following resources have been made available and produced through the Central Oklahoma Rural Partnership for Science (CORPS), a multi year collaborative partnership between 18 rural Oklahoma school districts focused on the implementation of phenomenon-driven three-dimensional (3D) teaching and learning in the 3rd through 12th grade science classroom.

The Oklahoma Department of Education would like to acknowledge the hard work that the teachers, school district partners, University of Oklahoma partners, and K20 Center project staff involved in the CORPS project put into making these resources available. A special thank you is extended to Noble Public Schools, who served as the Lead Education Agency for the project.

Teachers worked with curriculum and content specialists, and university level scientists and engineers to select appropriate phenomena to drive instruction and assessment. Utilizing these phenomena, the team of teachers, curriculum specialists, and content experts drafted the following resources. Each resource set has gone through extensive field testing and revision.

Partnering School Districts

Asher Public Schools

Lexington Public Schools

Ninnekah Public Schools

Tecumseh Public Schools

Blanchard Public Schools

Lindsay Public Schools

Noble Public Schools

Tuttle Public Schools

Bridge Creek Public Schools

Little Axe Public Schools

Purcell Public Schools

Wayne Public Schools

Chickasha Public Schools

Maysville Public Schools

Rush Springs Public Schools

Dibble Public Schools

Newcastle Public Schools

Stratford Public Schools

What is in a Phenomenon-Driven Three-Dimensional (3D) Instructional Set?

These resources utilize phenomena to facilitate 3D learning, instruction, and formative assessment. Each set contains three documents: 1) Instructional Task (IT); 2) Matched formative Assessment Task (AT); and 3) Associated Pattern Analysis of Student Thinking (PAST).

These resources are not intended to be a complete lesson plan.

- The IT proposes two or more possible phenomena that could be used to drive an instructional sequence addressing a specific OAS-S standard. It also provides suggestions for engaging students with the phenomena in three dimensions.
- The AT is centered on a phenomenon-associated scenario and contains one or more tasks designed to provide students with opportunities to show their thinking about the disciplinary core ideas (DCIs) using crosscutting concepts and scientific practices for that standard as they provide evidence-based explanations.
- The PAST document is directly associated with the AT. It provides a description of the intended purpose of each part of the AT and shows related student response themes to help identify patterns of student thinking. It also includes examples of student responses and teacher instructional moves for facilitating student understanding of the concept in that part of the assessment. The PAST could be used by individual teachers as a tool to construct a rubric for the AT.

Format of a Phenomenon Based instructional Task (IT)

TARGETED DCI AND/OR ASSOCIATED PE

This section identifies the Oklahoma Academic Standards for Science (OAS-S) performance expectation (PE) and related DCI that is the focus for learning experiences planned using this IT.

POSSIBLE DRIVING PHENOMENA

This section aims to provide two possible phenomena that could be used to engage students in the learning process by asking questions about the phenomena that can be investigated and explained using the science and engineering practices, crosscutting concepts, and disciplinary core ideas. These phenomena or other related phenomena could be used when planning for instruction.

Student observation or initial interaction

For each phenomenon, a short description is given to guide the students' first interaction with the phenomenon. Images and links to additional resources are provided when available.

Phenomenon explanation for teachers.

An in-depth explanation of the phenomenon is provided for the teacher as background knowledge. This information is meant for the teacher and is not meant to be directly given to the students or to use as a model for the expected level of student explanation at the end of instruction.

HOW DOES THE PHENOMENON CONNECT TO THE DCI OR PE?

This section aims to provide a coherent storyline of how the phenomena connects to the targeted PE and the related Science and Engineering Practices, Crosscutting Concepts, and Disciplinary Core Ideas. The color-coding in this section allows teachers to see possible connections between the three dimensions and the driving phenomena. To find out more about the three dimensions and how they are incorporated into the OAS-S, review pages 7-8 in the OAS-S.

GATHERING AND REASONING IN ORDER TO CONSTRUCT AND REFINE EXPLANATIONS

This section aims to provide recommended instructional support that the teacher can use when planning for 3D student learning experiences using the IT. Relevant science and engineering practices are presented as tasks that can be used to engage and explore students in investigating the phenomenon. Guiding questions utilizing the crosscutting concepts are provided for teachers to use to facilitate student thinking and classroom discussions that help the development of student understanding at a deeper conceptual level.

COMMUNICATE FINAL EXPLANATION OF THE PHENOMENON

This section aims to provide possible formats for students to construct and communicate their understanding of the DCI concept(s) through an explanation of the phenomenon. This allows the opportunity for students to share their ideas about how the concepts they have investigated relate to the phenomenon and lead to their application of the big science ideas to their understanding of how the world around them works.

How to use an IT for 3D instruction

A phenomenon-driven three-dimensional instructional task is not a lesson plan, but is intended to guide instructional decisions. Three-dimensional learning is not limited to one specific type of lesson format and is compatible with most lesson plan models. Each IT is intended to provide enough information so that teachers can create and adapt meaningful learning experiences relevant to the culture of their classroom and students, while not being so prescriptive as to hinder the creativity and personalization that professional educators bring to the craft of teaching. As such, teachers should use the suggestions provided in the IT to guide their thought processes as they plan for the 3D learning experiences in their classroom. These recommendations are meant to be used and adapted as needed and we hope that the information presented here inspires teachers to find and utilize phenomena to plan for other 3D learning experiences for their students.

Format of a 3D Formative Assessment Task (AT)

SCENARIO OR DRIVING PHENOMENON

Students are presented with a scenario involving a phenomenon that can be explained using the science and engineering practices, crosscutting concepts and disciplinary core ideas by connecting information provided in the scenario or analyzing data related to the phenomena.

TASKS

Students are presented with varying types of prompts that integrate scientific practices and crosscutting concepts into the assessment tasks. Student responses to the formative assessment tasks can be used to determine student's current understanding of disciplinary core ideas and crosscutting conceptual ideas. Most responses are open-ended and are designed to scaffold student responses toward more complex explanations.

HOW TO USE A 3D FORMATIVE ASSESSMENT TASK

Formative assessment tasks can be used to uncover student's prior knowledge, current understanding and response to instruction. Each 3D formative assessment task is matched to an instructional task and is intended to be used to uncover student thinking around the related DCI. The intent is to address the same concepts in both pairs of the set. However, the formative assessment tasks could easily be adapted for use as an instructional task and instructional tasks can be adapted for use as formative assessment. An option for administering the formative assessment task might be to use it as a performance task in which students interact with a phenomenon through classroom investigation. At this point student responses can be analyzed using a Facets of Learning approach or can be utilized to construct classroom level rubrics to evaluate student understanding.

Format of a Pattern Analysis of Student Thinking (PAST)

TARGETED PE AND DCI

This section identifies the Oklahoma Academic Standards for Science performance expectation(s) (PE) and related DCI(s) targeted for this AT. The targeted PE(s) and DCI(s) should be kept in mind as student responses are analyzed.

TASK ITEM ANALYSIS TABLE

Each task item analysis is presented in a table format with the following components: Task Item Description, Purpose, Student Response Themes, Examples of Student Responses, Possible Teacher Instructional Moves, and Focus SEP/CCC.

Task Item Description

This section provides a short description for the task item.

Purpose

This section provides an explanation of the task and the purpose for the items in the task. It explains the design and the intended focus of the task and provides expectations for what students should be able to do in relation to the task.

Student Response Themes

This section provides a few of the most common themes synthesized from student responses to the AT. The response themes provide a view of the common ideas communicated by students in response to each question on the task. Typically, the themes are presented so that the targeted response themes are described first and then any secondary response themes are listed.

Examples of Student Responses

This section provides a sampling of real student responses to the questions on the task directly related to the student response themes. The example student responses are typically listed from most closely related to the targeted response theme to the least logically related.

Possible Teacher Instructional Moves

This section provides instructional recommendations that can be utilized when teachers encounter students with responses indicating alternate or incomplete ideas related to the PE(s) and DCI(s).

Focus SEP/CCC

This section outlines the featured connections between the task and the Science and Engineering Practices and the Crosscutting Concepts.

HOW TO USE A PAST

The Pattern Analysis of Student Thinking is intended to be used in conjunction with the Formative Assessment Task. The PAST should be reviewed before and after administering the AT. The PAST will provide guidance and insight into how to interpret student responses and possible instructional moves can be enacted as a result of uncovering the students' thinking around a specific DCI concept. The PAST is not a rubric. Instead it is a tool for making instructional decisions based on the student thinking. The purpose of the PAST is to help teachers guide their 3D instruction based on student feedback gathered through the AT.