CORPS

Central Oklahoma Rural Partnership For Science

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

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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, as well as university-level scientists and engineers, to select appropriate phenomena to drive instruction and assessment. Using 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 use phenomena to facilitate 3D learning, instruction, and formative assessment. Each set contains three documents: an Instructional Task (IT), a corresponding formative Assessment Task (AT), and a corresponding 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 through meaningful learning experiences in three dimensions.
- The AT focuses on a phenomenon-associated scenario. It contains one or more tasks designed to give students opportunities to show their thinking and provide evidence-based explanations about the disciplinary core ideas (DCIs) using crosscutting concepts and scientific practices for that standard.
- The PAST document is directly associated with the AT. It describes the intended purpose of each part of the AT and includes relevant student response themes to help teachers identify patterns of student thinking. It also provides guidance and insight into how to interpret student responses and possible instructional moves for facilitating student understanding of a specific DCI concept. Individual teachers can use the PAST 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 the related DCI that is the focus for learning experiences using the IT.

POSSIBLE DRIVING PHENOMENA

This section provides two phenomena that can be used to engage students in the learning process. The goal is to inspire students to ask conceptually relevant questions, which they can then investigate and explain using science and engineering practices (SEPs), crosscutting concepts (CCCs), and disciplinary core ideas (DCIs). These or other related phenomena could be used when planning for instruction.

STUDENT OBSERVATION OR INITIAL INTERACTION

For each phenomenon, a short description of the task is provided to help the teacher guide 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 given directly to students or to model the expected level of student explanation at the end of instruction.

HOW DOES THE PHENOMENON CONNECT TO THE DCI OR PE?

This section provides a coherent storyline of how the phenomenon connects to the targeted PE and the related SEPs, CCCs, and DCIs. The color-coding in this section allows the teacher to see possible connections among 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 EVIDENCE AND USING REASONING TO CONSTRUCT AND REFINE EXPLANATIONS

This section provides recommendations for instructional support that the teacher can reference when planning for instruction using the IT. Relevant SEPs are presented as tasks that can be used to engage students in exploring and investigating the phenomenon. Guiding questions that focus on the CCCs are provided to help teachers facilitate student thinking and classroom discussions that develop student understanding at a deeper conceptual level.

COMMUNICATING UNDERSTANDING THROUGH FINAL EXPLANATION OF THE PHENOMENON

This section suggests possible formats in which students can communicate their understanding of the DCIs through constructing a final explanation of the phenomenon. This gives students the opportunity to share their ideas about how the concepts they have explored and investigated relate to the phenomenon. The goal is to lead students to apply these big 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 it 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 teachers can create and adapt meaningful learning experiences that are 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. With this in mind, teachers should use the suggestions provided in the IT to guide their thought processes as they plan for 3D learning experiences in the classroom. These recommendations are meant to be used and adapted as needed, and we hope the information presented here inspires teachers to find and use other phenomena to plan more 3D learning experiences for 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 science and engineering practices (SEPs), crosscutting concepts (CCCs), and disciplinary core ideas (DCIs) by connecting information provided in the scenario or analyzing data related to the phenomenon.

TASKS

Students are presented with varying types of prompts that integrate scientific practices and crosscutting concepts into the assessment tasks. Students' responses can be used to determine their 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

These tasks can be used to uncover students' prior knowledge, their current understanding, and their response to instruction. Each 3D formative assessment task is matched to an instructional task and is intended to uncover students' thinking about the related DCI. The intent is to address the same concepts in both tasks, but the formative assessment tasks could be adapted for use as instructional tasks and vice versa. 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 they can be used 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 (PE) and the related DCI(s) targeted for the 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 Teaching Moves, and Focus SEP/CCC.

TASK ITEM DESCRIPTION

This section provides a short description of the task item.

PURPOSE

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

STUDENT RESPONSE THEMES

This section lists some of the most common themes synthesized from student responses to the AT. These response themes provide an overview of the ideas that students may communicate in response to each question in the task. Typically, the themes are presented so that the targeted response themes are described first and any secondary response themes are listed afterward.

EXAMPLES OF STUDENT RESPONSES

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

POSSIBLE TEACHING MOVES

This section provides recommendations for instructional moves the teacher can use when student responses indicate incomplete or alternate ideas related to the PE(s) and DCI(s).

FOCUS SEP/CCC

This section outlines the featured connections between the task and the corresponding science and engineering practice(s) and the crosscutting concept(s).

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 teaching moves can be enacted as a result of uncovering students' thinking about a specific DCI concept. The PAST is not a rubric. Instead, it is a tool for making instructional decisions based on student thinking. The purpose of the PAST is to help teachers guide their 3D instruction based on student feedback gathered through the AT.