DOK and Degree of Dimensional Sense-Making in Science Assessments FAQ

Why is Oklahoma using Dimensional Sense-Making for science assessments rather than DOK?

The Oklahoma Academic Standards of Science (OAS-Science) are three-dimensional (3D) standards that pose a different definition of proficiency than those from previous versions of science standards. Combined with a meaningful application of the knowledge, 3D standards reflect how a student learns and how a student demonstrates proficiency. While assessing 3D standards, the assessment items are always phenomenon driven. Students are required to use their knowledge and understanding to make sense of a given scenario or phenomenon using common Science and Engineering Practices (SEP).

Depth of Knowledge (DOK) tends to base the complexity on the depth of engagement with the Disciplinary Core Idea (DCI) and the SEP without much emphasis on the Crosscutting Concept (CCC). The Degree of Dimensional Sense-Making not only accounts for the depth of understanding needed with each dimension, but also additionally accounts for the complexity of using that knowledge to make sense of the given phenomenon. Many times in 3D assessments, the knowledge required can be of a lower complexity while the task required to demonstrate said knowledge is of a higher complexity, or vice-versa. Therefore, Dimensional Sense-Making is a more effective way to assess the overall complexity of items on the Oklahoma School Testing Program (OSTP) and College and Career Readiness Assessment (CCRA) Science.

What is Depth of Knowledge (DOK)?

Depth of Knowledge is a way to measure the complexity of an assessment question ranging from Basic Recall to Extended Thinking. A question at the lowest level of DOK requires a student to perform tasks with basic recall of past knowledge; each additional level requires further application of knowledge or concepts. DOK has 4 levels that can be classified by a simple question:

DOK 1: What is the knowledge?
DOK 2: How can the knowledge be used?
DOK 3: Why can the knowledge be used?
DOK 4: What else can be done with the knowledge?

What is Degree of Dimensional Sense-Making?

Degree of Dimensional Sense-Making is a tool used to assess the Cognitive Complexity of a 3D science assessment question. Cognitive Complexity refers to the kind of thinking required to complete a task. Unlike prior tools for assessing the complexity of a question on a science assessment, Dimensional Sense-Making does not relate to the verbs in the question. Instead, the Dimensional Sense-Making analyzes the degree of sense making required by the student. Unlike DOK, the degree of Dimensional Sense-Making of 3D questions measures both the depth of engagement with each dimension of an assessed standard and the alignment to the assessed standard or Performance Expectation (PE). Per the Test and Item Specifications (TIS), all questions on the grades 5 and 8 science OSTP and the grade 11 CCRA science require engagement with at least 2 dimensions. Additionally, Dimensional Sense-Making is limited by the amount of scaffolding present in a cluster (stimulus and question). Questions of a higher degree of Dimensional Sense-Making having little to no scaffolding.

How is Sense-Making defined in Cognitive Complexity?

Sense-Making or "making sense" is defined as students connecting their understanding and abilities to new information to develop an understanding of the scenario presented. Rather than representing prior knowledge, the student should be using their knowledge to develop further understanding. Sense-Making should require the student to do at least one of the following:

- Identify and generate evidence
- Apply evidence to claims/ideas with reasoning
- Evaluate or critique claims
- Generate questions to guide exploration of a phenomenon or problem presented
- Create explanations for a phenomenon
- Make predictions about a phenomenon using the information provided

How does DOK differ from Dimensional Sense-Making in Science Assessments?

Depth of Knowledge defines complexity based on "knowing" and the extent to which that "knowing" is utilized or demonstrated by a task without specifically requiring connection back to a presented phenomenon. On the OSTP and CCRA science assessments, students are required to connect previously learned skills and knowledge to a presented phenomenon in order to develop new understanding of a concept. Additionally, DOK can help to confirm alignment with the SEP and DCI of an assessed Performance Expectation (PE).

Dimensional Sense-Making defines not only the complexity of the question, but also the question's alignment to the standard by assessing the depth of engagement with the all **3** dimensions. This categorization of complexity is a better scale for evaluating the complexity of the OAS-Science. Proficiency of the standards requires students to not only demonstrate knowledge, but also apply said knowledge to the phenomenon.

What are the Different Degrees of Dimensional Sense-Making?

Similar to DOK, Dimensional Sense-Making has 4 distinct degrees of complexity. These degrees are based on the alignment with the dimensions of the standard, amount of sense-making required, and the amount of scaffolding present in the cluster. The 4 degrees are defined below ranging from lowest to highest:

Scripted – One dimension is foregrounded with the other(s) backgrounded

- Extensive scaffolding
- Minimal to no sense-making required

Low Guided – Multidimensional with one dimension heavily foregrounded over the other(s)

- Moderate scaffolding
- Low degree of sense-making required

High Guided – Multidimensional with at least 2 dimensions being used (foregrounded) equally

- Minimal Scaffolding
- High degree of sense-making required

Doing Science – All 3 dimensions are foregrounded centered on student-designed exploration of science

- Minimal to no scaffolding
- Students are required to "do science" as they develop or deepen understanding of a scientific idea as they explore a phenomenon

What is the Difference between Backgrounded and Foregrounded Dimensions?

Backgrounded dimensions are categorized by the possibility for a student to use the dimension, but not necessarily required for all students or every approach. A backgrounded dimension tends to have a very limited application and is not used in sense-making. Often with a backgrounded dimension, a single component is drawn upon rather than multiple parts or even the entire dimension as is seen in foregrounded dimensions.

Foreground dimensions are categorized by their necessity in the student's sense-making. Usually the dimension is used in a sophisticated way rather than just a basic connection or application. Foregrounded dimensions are used to either bridge a gap in other dimensions [i.e. Crosscutting Concepts (CCC) used to bridge gap in DCI knowledge] or connect another dimension of the standard to the phenomenon (i.e. SEP used to connect DCI knowledge to the phenomenon).

Backgrounded and foregrounded, as used in defining the complexity of an item, only refers to use of that dimension in a specific item or cluster. The categorization has nothing to do with the importance of that dimension within the standard itself. That being said, a dimension can change classifications – backgrounded, foregrounded, or even absent – from item to item within a cluster depending on its specific use within an item.

What is Scaffolding and How is it Defined in Cognitive Complexity?

Scaffolding refers to the information given to the student through the stimulus/questions that could be used to guide the student in their sense-making. Scaffolding also limits the amount of background knowledge and skills that the student needs to access in order to correctly answer a question. As a result of the diversity of the assessed standards on the CCRA Science and the multiple course pathways students may take in high school, clusters on this assessment will naturally have some degree of scaffolding present to make them accessible to all students.

Scaffolding has a large impact on the degree of Dimensional Sense-Making of a question. Questions that provide support to students during the sense-making will naturally lower the cognitive demand. Whereas, questions requiring students to guide themselves in their own sense-making have a higher cognitive demand. Dimensional Sense-Making is based on a combination of the depth of engagement with the dimensions and the amount of scaffolding. However, scaffolding does have a greater impact on the overall cognitive demand.

More information regarding the development of the OSTP and CCRA Science Assessments can be found in the Test and Item Specifications.

CCRA Test and Item Specifications

OSTP Science Test and Item Specifications – Grade 5

OSTP Science Test and Item Specifications – Grade 8