

## Addressing Challenges When Designing NGSS Aligned 3-Dimensional Assessments for Young Learners

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**Abstract:** The National Research Council (NRC) Framework and the Next Generation Science Standards (NGSS) emphasize that all students, beginning in the earliest grades, must have opportunities to learn science. As science curricula for elementary school is being developed, the need for NGSS-aligned assessments increases. This paper describes three challenges (defining assessment targets, gathering desired evidence, and structuring and scaffolding tasks) when designing NGSS standards-aligned first grade assessments and potential solutions to these challenges.

**Keywords:** assessment design, Next Generation Science Standards, early elementary

### Introduction

The Next Generation Science Standards (NGSS, Lead States, 2013) includes science instruction at the early grades (K-2). Including science in early grades instruction has increased the need for science assessments that are appropriate for young learners' cognitive and language development and provides teachers with information about what their learners know and are able to do in science. We describe 3 main challenges when designing NGSS aligned life science assessments for 1<sup>st</sup> grade and potential solutions to the challenges.

### Background

There are many reasons why early childhood assessment is difficult, including the variable and uneven development of young children, differing opportunities young children have to learn, the range of experiences young children have in the real-world, and the propensity of young children to demonstrate what they know and can do rather than talk or write about what they know and can do (The National Education Goals Panel Early Childhood Assessment Resource Group, 1998). Because of such variability, early childhood assessment is typically a multifaceted system comprised of gathering data using different methods such as observations, interviews, and portfolios (Slentz, 2008). Little literature on design principles (Scott-Little & Niemeyer, 2001) or frameworks to design early childhood assessments can be found, especially in science. Designing for early elementary students should include opportunities for students to engage with science concepts using tasks that are appropriate for students at different developmental stages. Currently there is little guidance on how to design assessments that target science learning, and cognitive or language development of young learners. We describe our approach to addressing challenges in designing a 1<sup>st</sup> grade science assessment task for performance expectation (PE) LS1-1 "Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs".

### Challenge 1: Defining measurement targets

The NGSS performance expectations (PEs) are 3-dimensional, with each PE incorporating disciplinary core ideas (DCI), science practices (SP), and cross-cutting concepts (CCC). While the DCI tends to differ between grades, the SPs and CCCs are shared across grade levels. A challenge was identifying the grade level boundaries for these dimensions and developing measurement targets that specify how the SPs interact with the DCI and CCC in a way that was developmentally appropriate for first graders. For example, for PE1-LS1-1, we used drawings and written descriptions to address the CCC and narrowed the DCI to focus on animals that are familiar to first graders. The resulting measurement target for PE 1-LS1-1 was (*italics added for emphasis*) "Ability to design a solution, through *drawing and/or describing*, to a given problem that is based on a *familiar animal part* that helps that the animal survive, grow and/or meet its needs."

### Challenge 2: Gathering the desired evidence

Determining how to gather appropriate evidence can be challenging because 1<sup>st</sup> grade students have varying levels of oral language competency, word reading ability, and writing proficiency. Additionally, our assessments were limited to the paper and pencil format, making tasks that require skills in designing solutions challenging. Since

we decided to allow students to express their understanding by integrating drawing and writing modalities as their responses, gathering student evidence involved examining and interpreting student drawings and determining how well their drawings aligned to the PE. Evidence of proficiency focused on the extent to which the design was related to the animal body part that the students identified and whether or not their design would be an appropriate solution to the human problem. We also analyzed how well the descriptions of their drawings articulated a solution to the human problem. Student textual descriptions were scored for students' intentions behind the description rather than grammar or spelling.

### **Challenge 3: Determining the structure of tasks and amount of scaffolding**

Another challenge was to determine how to structure each task including the degree to which and the type of scaffolding to provide support to students when engaging with the assessment task. In one-on-one administration, alternative prompts are often developed in case students are unable to respond to the initial prompt. This type of structure is not available in an assessment that does not respond to individual students. Our design process addressed this challenge by examining the task and determining 1) the information students need to answer the questions, 2) whether students need all of the information at once or if the information can be broken up to help students focus on the goal of a particular question, and 3) how questions can be organized to walk the students through the question without giving away the responses.

For PE 1-LS1-1, students were asked to design a solution, modeled after an animal body part that can reach an object that was far away (i.e., high above the head). For this task, students were given 3 options of animals: a bird, a giraffe, and an elephant. We used animals that we believed most 1<sup>st</sup> graders were familiar with and allowed students to pick the animal that could serve as a model for their design solution. Giving students choice increased the chance that students would be familiar with the animal and subsequently design a solution that aligned with the animal. We represented each animal in the motion of reaching for an object that was high in elevation to support students in making the appropriate connections between the animal and their design. The task asked students to draw a circle around the body part that the design solution would be modeled after to help students focus on their design features. We allowed students to provide written responses in addition their drawing to allow multiple opportunities for students to express their developing proficiency.

### **Discussion**

Addressing challenges related to language development, literacy skills, and the developmental stage of students can inform the development of 3-dimensional NGS aligned assessment tasks, the associated rubrics, and the nature of the administration prompts and scaffolds. Developmental characteristics of early learners are attended to throughout the design process in order to ensure the assessment tasks are developmentally appropriate. While this type of process is critical for any grade range, explicitly laying out what is required of students in terms of their language and literacy capabilities is particularly important at the early grades. Recognizing that there is a range of abilities in classrooms and highlighting ways to ensure that everyone can engage with the task will help ensure that students are able to demonstrate their proficiency related to the PE. The resulting assessment scores will be a more accurate portrayal of student's science ability and not a measure of their ability to read and write.

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