STANDARD 2: LEARNING TASKS HAVE HIGH COGNITIVE DEMAND FOR DIVERSE LEARNERS

Teachers support student learning through the provision of learning tasks. Not all tasks are created equal; different tasks require different levels of thinking. It is the level of thinking in which students engage that determines what they will learn [1]. Standard 2 addresses the idea that learning tasks should engage all students in high levels of thinking. Specifically, tasks with "high cognitive demand" generally have the following characteristics:

1) They engage students in important subject-matter content and processes that support deep learning (cf. the Common Core State Standards) [2-4].
2) They progressively develop important subject-matter content that builds increasingly to more sophisticated and more complex understanding of concepts, which are organized into schema [5, 6], or to the acquisition of more complex and sophisticated skills;
3) They support students to learn in and through their Zone of Proximal Development (ZPD) [7].

With respect to this principle, high cognitive demand does not refer to the hardness or difficulty of a task per se, but rather to the appropriate level of challenge that the task poses for each student so that an incremental forward movement of deep and important learning is achieved (e.g., [8, 9]). Because this principle also focuses on high cognitive demand for diverse learners, the nature and level of the task will vary among students [10]. Regardless of any variation in tasks among students, high cognitive demand is essential for all students and is not reserved for the more advanced.

How would you explain "appropriate level of challenge" in relation to high cognitive demand?

TASKS THAT SUPPORT DEEP LEARNING IN SUBJECT-MATTER CONTENT

In current reform efforts (for example, implementation and assessment of the Common Core State Standards and Next Generation Science Standards), high-level cognitive abilities are reflected across subject-matter content. These abilities and skills include:

1) Asking questions and defining problems;
2) Making sense of problems and solving them;
3) Reasoning abstractly and quantitatively;
4) Constructing viable arguments;
5) Engaging in arguments from evidence;
6) Obtaining, evaluating, synthesizing and communicating information [11].

The success of students in developing these kinds of cognitive abilities and skills is

dependent on their engagement in deep and rich tasks that afford such opportunities [1, 12, 13]. For example, in mathematics, Lesh, Hoover, Hole, Kelly, and Post proposed model-eliciting tasks, which they contrasted with traditional problem solving activities found in textbooks [14]. The latter required students to produce an answer to a question that was formulated by someone else, whereas model-based activities required students to develop a model for interpreting the goals and potential solutions of an authentic, relevant problem. The approach of Cognitively Guided Instruction in mathematics ([15, 16]) provided students with learning tasks created from a model of student thinking that engaged them in high-levels of cognitive demand. This approach resulted in higher mathematics achievement.

There is consensus among scholars in the learning sciences that students attain deep knowledge when engaged in tasks that are authentically related to the everyday practices of professionals in the discipline. This is not to say that students' academic situations need to be identical to professionals, but rather that learning strategies and contexts are most advantageous to learning when they are similar to those within the discipline while also being age appropriate and retaining fundamental, disciplinary practices and beliefs [17].

If you had to write one sentence about tasks that develop deep understanding, what would it be?

A committee of the National Research Council [6] explicated the principles outlined in the Council's influential synthesis of cognitive research [18] and applied them to subject-matter content. The committee advanced the idea that students should be involved in learning concepts about the nature of the subject matter (for example, what it means to engage in doing history, math, or science) and concepts that are central to the understanding of the subject matter (for example, exploration of the new world, mathematical functions, or gravity) [6]. In addition, some research has shown that regardless of the subject matter, students who engaged in tasks with high cognitive demand that developed deeper, more generative understandings with respect to the ideas they are learning about learned and retained more [19-24].

As discussed in the section on Standard 1, the development of schema is important for learning and for transfer. Schemata enable learners to apply what they have learned in a new situation and to acquire related new learning more quickly [25, 26]. Learning tasks that connect new learning to prior learning in networks structured around key ideas of the subject-matter can support the development of schema (cf. [27]).

THE ZONE OF PROXIMAL DEVELOPMENT

In his still influential formulation, Vygotsky stated that instruction "must be aimed not so much at the ripe as at the ripening functions" ([28], p. 188). To aim instruction at the "ripening functions" teachers need an indication about a student's zone of nearest development (also termed the zone of proximal development – ZPD). Vygotsky described

the ZPD as "those processes in the development of the same functions, which, as they are not mature today, still are already on their way, are already growing through, and already tomorrow will bear fruit" ([29], p. 120). In this regard, Vygotsky also distinguished between two levels of development: 1) the level of actual development that the learner has already reached, the level at which the learner is capable of solving problems independently; and 2) the level of potential development (the ZPD), the level that the learner is capable of reaching under the guidance of a more knowledgeable other. Applied to the classroom context, this means that teachers engage students in learning that is within their ZPD, (not too hard and not too easy) through tasks and interactions that involve a gradual release of assistance so that the learning ultimately becomes part of the student's independent achievement [30].

How does ZPD relate to a gradual release of assistance?

In summary, providing opportunities for all students to engage in tasks of high cognitive demand supports deep learning of important subject-matter content and can assist in the development of schema. Ensuring appropriate high cognitive demand for all students requires teachers to be aware of learner differences and match the tasks to the learners' needs.

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