Now That's a Good Question!

How to Promote Cognitive Rigor Through Classroom Questioning

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Introduction: What Does a Good Question Do?

You are teaching a lesson on identifying arithmetic patterns and how to explain them using the properties of operations. You present your students with the following math equations:

2 x 2 =
3 x 3 =
4 x 4 =
5 x 5 =
6 x 6 =
7 x 7 =
8 x 8 =
9 x 9 =

As your students prepare to solve the problems, you surprise them by presenting this material:

2 x 2 = 2 + 2
3 x 3 = 3 + 3 + 3
4 x 4 = 4 + 4 + 4 + 4
5 x 5 = 5 + 5 + 5 + 5 + 5
6 x 6 = 6 + 6 + 6 + 6 + 6 + 6
7 x 7 = 7 + 7 + 7 + 7 + 7 + 7 + 7
8 x 8 = 8 + 8 + 8 + 8 + 8 + 8 + 8 + 8
9 x 9 = 9 + 9 + 9 + 9 + 9 + 9 + 9 + 9 + 9

You then ask your students to respond to the questions in Figure 1.

Figure I The Cognitive Rigor Question (CRQ) Framework: Multiplication

ESSENTIAL	**Universal**	How can amount be determined?
	Overarching	How does mathematics involve abstract and quantitative reasoning?
	Topical	How can problems involving multiplication be represented and solved?
	Driving	How could you solve word problems using the following to represent the multiplication problem? • Drawings • Equations • A symbol representing the unknown number in the problem
FACTUAL		What is multiplication? What is the multiplier? What is the multiplicand? What is the product? What is a factor or coefficient?
ANALYTICAL		How can the products of whole numbers be interpreted? How can the unknown factor or product in a multiplication problem be determined given the following? • One factor and the product • Both factors (the multiplier and the multiplicand)
REFLECTIVE		What is the connection between addition and multiplication? What impact does the multiplier have on the multiplicand and the product?
HYPOTHETICAL		What if the multiplier in the given example problems were one more or one less? How could multiplication be used to solve problems involving the following? • Equal groups • Arrays • Measurement quantities
ARGUMENTATIVE		Is it easier to add or multiply?
AFFECTIVE		How could you interpret products of whole numbers in a certain context? How could you use multiplication within 100 to solve word problems? How could you determine the unknown product in a multiplication problem given the two factors (the multiplicand and multiplier)? How could you determine the unknown factor in a multiplication equation given one factor and the product?
PERSONAL		What do you want to learn about multiplication?

What are your students expected to do in this lesson—or rather, how deeply are they expected to communicate their learning? Clearly, you've asked students to "do the math," but the second set of math problems challenges your students to think deeply and to share their perspectives on how and why multiplication can be used to answer questions. That's the transferable knowledge we want them to learn so they can solve any multiplication problem they encounter.

So how might your students address the problems you've posed using the questions in Figure 1? The following are some potential outcomes. The students might:

- Say that multiplication is just "repeated addition" and explain how this process works using the examples you've provided.
- Demonstrate how whole numbers can be interpreted by explaining that 2×2 is actually the number of times that the number 2 is added to itself to attain the product of 4.
- Explain that the product of 3×3 is equivalent to adding 3 to itself three times. A visual solution might be to imagine adding up the total number of blocks in three block sets with each block set containing three separate blocks.
- Draw three sets of circles in three different places on a piece of paper and add them to get the correct result.

Any of these approaches fit this book's definition of the learning outcomes made possible by good questions. That's because good questions challenge students to do the following:

- **Read and research** texts and topics to build background knowledge.
- **Examine, experiment with, and explain** how and why concepts and procedures can be used in a variety of contexts.
- **Investigate and inquire** about what else needs to be known, could be done, or should be considered.
- **Design to demonstrate, develop, and differentiate talent and thinking** by showing what *you* can do with what *you* have learned.

These are the essential skills our students must learn. They also mark and measure what it truly means for a student to be college- and career-ready, including the ability to process their education and experience into expertise that they can transfer and use to address and respond to questions, problems, tasks, texts, and topics. These essential skills are also what students need to use to demonstrate and communicate their ability to think deeply and share the depth and extent of their knowledge and understanding.

The performance objectives of academic standards do not directly address these essential skills. The performance objectives are generally subject-specific learning goals or targets that set the criteria for what students must *demonstrate* or *show* they know, understand, and can do by the end of a particular grade level. They do not necessarily set the expectations for students to *communicate* or *tell* the depth and extent of their learning unless they are directed to *define, describe, explain, state*, or *write.*

However, these objectives can be developed into open-ended, thought-provoking good questions that will challenge students to demonstrate and communicate their knowledge and thinking.

We cannot simply rely on the curriculum to help students develop deeper thinking and learn how to transfer knowledge. Each passage or problem is an example or opportunity for students to apply what they are learning, but answering the questions or accomplishing the tasks correctly does not indicate that students truly learned the concept or content as deeply as they should. The accomplishments may merely indicate the students understood that specific text or were able to solve that particular problem. They do not guarantee that the students' response will be as cognitively complex as the question. As Gall (1970) explains, "It is not always possible to know whether a student answered a particular question by using a high-level cognitive process, such as analysis or synthesis, or by using the relatively low-level process of knowledge recall" (p. 710).

The good questions that we ask our students will not come from the standards or the texts. They will come from teachers and from our students. The questions, problems, tasks, texts, and topics presented in our curriculum can serve as the textual evidence that students can use to support their responses to good questions.

When we ask our students good questions, our objective is not only to assess what they know or what they can do with what they have learned. It is also to explore how deeply they are able to respond to questions. As Dillon (1988) puts it, "Our proper interest is not in the production of the correct answer but in the answer the student produces" (p. 67).

The true purpose and promise of this book is not merely to provide a description of a good question for educators or a list of good questions to ask students. The objective of this book is to help the reader understand how to craft good questions that do the following:

- Stimulate students' deeper thinking.
- Deepen students' knowledge, understanding, and awareness.
- Expand students' knowledge and extend their thinking.

- Pique students' curiosity, imagination, interest, and wonder.
- Encourage students to share the depth of their learning.

This book guides educators to create good cognitively rigorous questions that meet the criteria found in both Bloom's Revised Taxonomy and Webb's Depth-of-Knowledge (Hess, Carlock, Jones, & Walkup, 2009a, 2009b). It also shows how to develop good questions by rephrasing the learning goals and performance objectives from the following college- and career-ready academic standards:

- Common Core State Standards (CCSS) for English Language Arts and Literacy. From ©2010 National Governors Association Center for Best Practices and Council of Chief State School Officers (NGACBP & CCSSO). All rights reserved.
- Common Core State Standards (CCSS) for Mathematics. From ©2010 National Governors Association Center for Best Practices and Council of Chief State School Officers (NGACBP & CCSSO). All rights reserved.
- Next Generation Science Standards (NGSS). From NGSS Lead States, 2013. *Next Generation Science Standards: For States, By States*. Washington, DC: The National Academies Press.
- National History Standards (NHS). From National Center for History in the Schools, University of California, Los Angeles. ©1996 Regents of the University of California.
- College, Career, and Civic Life (C3) Framework for Social Studies State Standards. From National Council for the Social Studies (NCSS), *The College, Career, and Civic Life (C3) Framework for Social Studies State Standards: Guidance for Enhancing the Rigor of K–12 Civics, Economics, Geography, and History* (Silver Spring, MD: NCSS, 2013).

Good questions serve as the formative and summative assessments that measure the extent of a student's learning and they set the instructional focus for an active, student-centered learning experience.

When reading this book, do not focus solely on identifying the definition of good questions or picking examples of good questions. Instead, consider how you will use the information to develop learning experiences that are driven by inquiry and aimed at encouraging students to think deeply and share their learning.

If your students are demonstrating and communicating—or showing and telling—the depth and extent of what they are learning, then you'll know you've asked a good question.