Time for Revision: Updating the Framework to Stay Current

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The time has come for the *Mathematics Framework for the 2017 National Assessment of Educational Progress* (NAEP) to be updated. Regardless of how one feels about the value of the Common Core State Standards for Mathematics (CCSS-M), there is little doubt that most states either use those standards or have created their own standards that very closely model the CCSS-M. With the overwhelming majority of American students now learning the same mathematical content in the same grades, it is time for the NAEP framework to better reflect this.

When I was an early career teacher, I remember an administrator talking about three types of curriculum—the written, the implemented, and the assessed (English, 1992). When all three match, true progress can be made. These three don't currently match and it is time to make some changes to the assessed curriculum. This paper will elaborate on why changes should be made to the NAEP Mathematics Framework and what types of changes should be made.

There are several instances where content is tested before most state standards have it taught. The first is **fourth grade Statistics and Probability**. Work with measures of center (mean, median, mode) is found in 6th grade standards. While work with this topic is likely begun informally in prior grades (Cohen, 2012), the formal language occurs in 6th grade state standards and it seems quite unfair to test language in 4th grade that the students haven't yet formalized. The same concern occurs for the concept of range. It is definitely addressed in earlier grades, but in the context of number operations. For example, students are asked to find the difference between the highest and lowest dots in a line plot with fractions in the 4th grade CCSS-M

(4.MD.4), without formally calling it the range. A greater area of concern is probability, which should not be tested in 4th grade. In state standards, formal work with probability now begins in 6th grade. Students have little exposure to formal probability language in prior grades.

A second major area that includes content taught in later grades is **fourth grade Algebra**. In the existing framework, 4th grade students are asked to recognize and describe proportional relationships. However, this is a topic that isn't formally addressed with the use of proportional language until 6th grade. The notion of a variable, which is a letter used to represent a number, begins in 6th grade in most state standards. However, there are several places where variables appear in the 4th grade in the NAEP Mathematics Framework. As an eighth-grade teacher, I still have a few students who struggle with the concept of a variable after several years of working with them; it definitely shouldn't be tested in 4th grade with no prior exposure to the concept.

There are also instances of content included in state standards that are not in the existing framework. As Hughes, Daro, Holtzman, and Middleton (2013) have argued, not including content that is taught can result in NAEP underestimating student growth. Because of this, major content that is taught should be assessed by NAEP.

The biggest example of this omission occurs in 8th grade. Solving systems of equations, both graphically and algebraically, is included in 8th grade state standards, but is not assessed until 12th grade by NAEP. In fact, solving systems of equations (as well as work with linear equations) is one of the three major focal areas for the grade 8 CCSS-M. Not including this topic that eighth graders spend a significant amount of time learning should be changed.

These examples of content mismatches between what is being taught and what is being assessed highlight the necessity of a mathematics framework update. In addition, consideration needs to be given to how the existing framework standards are written and assessed.

Current state standards put a heavier emphasis on a balance between conceptual understanding, procedural fluency, and applications than did prior sets of standards; this balance is often referred to as "rigor." It is no longer good enough that students can memorize a procedure (algorithm) for solving a problem; they now need to understand why it works and be flexible in their reasoning. When many teachers were in school, they learned to add multi-digit numbers or multiply two 2-digit numbers by memorizing the steps and then repeatedly practicing them to gain procedural fluency. Current state standards call for solving such problems based on strategies and algorithms based on place value understanding and on properties of operations to gain conceptual understanding. This major shift should be reflected in an updated mathematics framework, as the existing framework focuses more heavily on procedural fluency than conceptual understanding. As the National Council of Teachers of Mathematics (NCTM) advocates, procedural fluency should be built from conceptual understanding (NCTM, 2014).

Changes to the formats and types of questions should also be considered. A major change with the adoption of CCSS-M and other state standards is the inclusion of the Standards for Mathematical Practice, a set of eight (some states have a different amount) "habits of mind" that students should develop. One of these practices, "Construct viable arguments and critique the reasoning of others" should be reflected in an updated mathematics framework. There should be questions on future NAEP mathematics assessments that ask students to demonstrate this important skill; this could be done with either selected response or constructed response items.

With the transition to digital NAEP, consideration should be given to including selected response items with multiple correct answers. This is already occurring in many states and should be included on NAEP. Students can no longer guess on an item and randomly select the one correct answer; they need to reason through each of the items and determine which ones apply. These multiple correct response items would be a great way to assess the conceptual understanding of students as well as allowing them to critique the reasoning of others.

The above suggested changes illustrate the necessity of revising the mathematics framework. The framework needs to be revised, but creating an entirely new framework is unnecessary. The work to be done can be accomplished within the existing framework; the vast majority of which is still relevant. Determining the actual changes should, as in the past, include input from a variety of constituents, including classroom teachers.

Ideally, these changes could be made while maintaining the existing trend line, so that student performance can be compared to past years. This ability to compare with past years is a strength of NAEP. Assessment experts would have to be consulted to determine the feasibility of maintaining trend following changes to the framework.

References

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