National Assessment Governing Board

Assessment Development Committee

May 18, 2017

AGENDA

10:30 – 11:20 am	Welcome and Introductions *Shannon Garrison, Chair*	
	Review of Mathematics Curricular Standards (*SV #5*) *Will (Tad) Johnston, AIR* *Beth Ratway, AIR*	Attachment A
11:20 am – 12:45 pm	Panel Discussion: NAEP Assessment of Mathematics (*SV #5*) *Zalman Usiskin, Director, University of Chicago School Mathematics Project* *Kevin Dykema, Teacher, Mattawan (MI) Middle School* *Gladis Kersaint, Dean & Professor, University of Connecticut* *William McCallum, Professor, University of Arizona* *Diana Suddreth, Director of Teaching and Learning, Utah State Board of Education* *Moderator: Dale Nowlin, ADC Member*	Attachment B
12:45 – 1:00 pm	Debrief: Next Steps for ADC Framework Activities *Shannon Garrison*	Attachment C
Information Items	Item Review Schedule	Attachment D

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REVIEW OF STATE CURRICULAR STANDARDS IN MATHEMATICS

OVERVIEW

In August 2017, the Governing Board awarded a contract to the American Institutes for Research (AIR) to conduct a Review of State Curricular Standards in Mathematics. The goal of the project was to develop a descriptive and detailed picture of how mathematics curricular content across states relates to what NAEP assesses in mathematics. This was accomplished by collecting the mathematics content standards for grades K through 8 across states, the District of Columbia, and the Department of Defense Education Activity (DoDEA), and comparing them to the assessment objectives in the 2017 NAEP Mathematics Framework for grades 4 and 8. At the May 2018 Governing Board meeting, the AIR project team will provide a results briefing for the Assessment Development Committee (ADC) and the full Board.

PROJECT TEAM

The project leaders include Project Director Maria Stephens, responsible for providing day-to-day leadership, and Task Leaders Tad Johnston and Beth Ratway, responsible for organizing and conducting the comparisons. Maria Stephens has over 15 years of experience in leading content comparison studies and reports, with a focus on NAEP and international assessments. Mr. Johnston has over 20 years of experience as a mathematics educator across all levels of education and has served as a content expert on numerous studies related to national and state mathematics standards. Ms. Ratway's experience focuses on standards analysis, development, and implementation, including comparative reviews of mathematics standards and financial literacy standards in several states. In addition to three project leaders, the project team includes additional mathematics specialists, senior-level quality assurance reviewers, and research assistants.

PROJECT APPROACH

The work to compare state mathematics standards with NAEP was conducted using a combination of external experts and mathematics specialists within AIR. The Common Core State Standards in Mathematics (CCSS-M) were used as a proxy for the standards of the states that adopted the CCSS-M without changes, reducing the workload from what would otherwise be 52 individual comparisons. For the remaining states, AIR used either their comprehensive list of standards (for non-adopters of CCSS-M) or a partial list of standards encompassing those distinct from CCSS-M (for partial adopters of CCSS-M, i.e., states that adopted CCSS-M but changed or supplemented the standards).

The project approach involved AIR specialists conducting extensive preparatory work to identify preliminary groupings of NAEP objectives and state standards with overlapping content,[1] which

[1] Generally speaking, state standards for Grades K–4 were reviewed for possible groupings with NAEP grade 4, and state standards for Grades 5–8 were reviewed for possible groupings with NAEP grade 8—though the AIR

were then reviewed and rated for content alignment by a Content Review Committee (CRC) consisting of 15 external experts. The key research question for the CRC's task was: ***What is the degree of content alignment between grouped NAEP objectives and state standard(s)?*** Put another way, the CRC addressed the question: Based on the state standards that were grouped with the NAEP objective, would students have had the opportunity to learn what is being assessed?

For each preliminary grouping of a NAEP objective with one or more state standards, the CRC rated the grouping as:

- ***Extended***, to indicate the grouped state standard(s) aligns with all of the NAEP objective and also includes content that extends beyond the NAEP objective and is not found elsewhere in the NAEP grade. That is, students would have had the opportunity to learn all of what NAEP is assessing as well as extra content not found elsewhere in NAEP.
- ***Complete***, to indicate the grouped state standard(s) aligns with the entire NAEP objective. That is, students would have had the opportunity to learn all of what NAEP is assessing.
- ***Partial***, to indicate the grouped state standard(s) aligns with part of the NAEP objective. That is, students would have had the opportunity to learn part of what NAEP is assessing but something is missing from the state standard that is covered in NAEP (and there may also be extra content in the state standard).
- ***Not aligned***, to indicate no state standard aligns with any part of the NAEP objective. That is, students would *not* have had the opportunity to learn what NAEP is assessing.

In addition to the ratings, the process captured ***Missing Content***, content covered in NAEP objectives but not covered in the grouped state standard(s), and ***Extra Content***, content that state standards included but were not included in NAEP objectives. Missing and Extra Content were identified through comments collected alongside the ratings and the state standards that could not be grouped with any NAEP objective (i.e., were unique).

A sampling plan assigned CRC members to subsets of states (three reviewers each to five subsets) to manage the volume of states. The CRC received training by webinar and provided ratings independently. They then met in person to come to consensus on aggregate ratings for each preliminary grouping of state standards, discuss alternative groupings, and come to consensus on state standards identified as unique. From these discussions, AIR specialists summarized the Extra Content in state standards and the NAEP content missing from state standards. The specialists then searched for the Missing Content in states' standards in mandated subjects outside of mathematics.

Altogether, the comparison activities resulted in a detailed picture of content overlap relative to three types of standards documents: NAEP mathematics objectives, state mathematics

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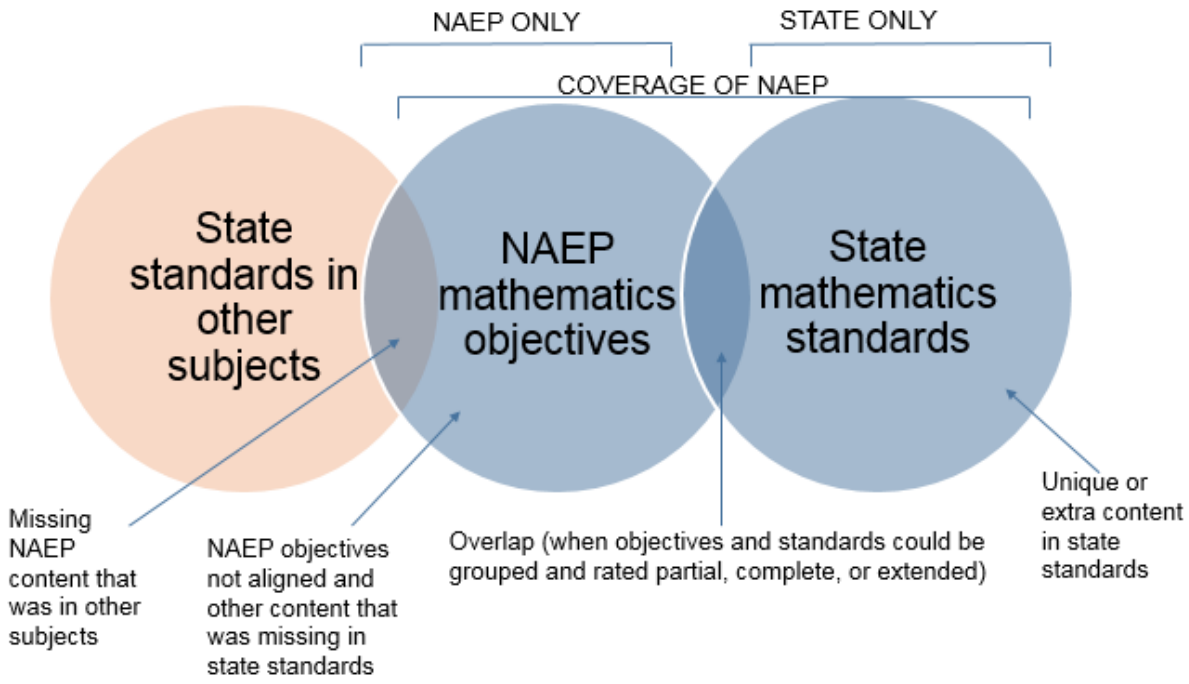
specialists documented whether any of the state standards at grades K–4 that were deemed unique from NAEP grade 4 have content overlap with NAEP grade 8 (and vice versa). Comparisons focus on the conceptual match in mathematics content between the NAEP objectives and state standards, excluding consideration of the level of cognitive complexity represented in the content.

standards, and state standards in mandated subject areas outside of mathematics, as noted in the following figure.

Comparing NAEP Mathematics Objectives and State Standards



RECENT ACTIVITY: CRC CONSENSUS MEETING, ANALYSIS, AND TAC MEETING

The **CRC Consensus Meeting** was held on February 6-8, 2018 in Washington, DC, with all 15 CRC members. The meeting was conducted primarily in subgroups facilitated by AIR specialists. To prepare for the meeting, the AIR project team compiled individual ratings in a consensus document for each state reflecting preliminary aggregate ratings (thresholds below). Discussions at the meeting focused on coming to consensus on final aggregate ratings for the groupings classified as "not determined" in the consensus documents.

Preliminary Aggregate Rating	Threshold for Assigning Preliminary Aggregate Rating
Extended	if all reviewers rated the grouping as extended
Complete	if at least two-thirds of reviewers rated the grouping as complete and the remainder as partial
Partial	if at least two-thirds of reviewers rated the grouping as partial and the remainder as complete
Not aligned	if all reviewers agreed that the NAEP objective could not be grouped with any state standard
Unique	if all reviewers agreed that the state standard could not be grouped with any NAEP objective
Not determined	for any other combination of ratings

Day 1 focused on the comparisons of NAEP with *CCSS-M*. Based on observed discrepancies in individual ratings, a select group of NAEP objectives that required clarification were reviewed in

plenary with all 15 reviewers. Subsequently, three groups of five reviewers each discussed the remaining "not determined" objectives by content area.

Day 2 focused on the comparisons of NAEP with the subset of 9 states that were treated as *non-adopters* of CCSS-M. For these discussions, the CRC was split into five groups of three raters each.

Day 3 focused on comparisons of NAEP with the subset of 23 states that were treated as *partial adopters* of CCSS-M, using the three groups of five reviewers each from Day 1. Addressing these states on Day 3 allowed Day 1's CCSS-M decisions to be compiled and reflected in the consensus documents for the partial adopters, thereby ensuring consistency in ratings for objectives and groupings that were similar in CCSS-M and the partial adopter states. Highlighting within these updated consensus documents noted objectives with wording differences relative to the relevant CCSS-M standard(s), and these state-specific differences were the focus of discussion. CRC members were asked: "Do the differences present in the grouped state standards warrant a change in the rating the CRC had earlier assigned to the analogous NAEP/CCSS-M grouping?" If the answer was no, then the CCSS-M rating was assigned as the final aggregate rating. If the answer was yes, then the subgroup discussed which alternative rating was appropriate as the final aggregate rating.

Across all states and groups, ***discussions aimed for consensus but allowed a final aggregate rating with two-thirds in agreement*****,** when necessary. Following the CRC Consensus Meeting, the mathematics comparisons data were cleaned and compiled for preliminary **analysis** around the three areas of interest:

- a state-by-state picture of the coverage of NAEP objectives by state mathematics standards
- NAEP content that is not covered in state mathematics standards (Missing Content) and the extent to which it may be covered in the curricula of states' other mandated subjects
- a set of consolidated state mathematics content standards that are not reflected in the NAEP framework and the extent to which these are covered across states (Extra Content)

Analyses included both quantitative analyses (such as identifying modal ratings for each objective, counting objective-level coverage ratings across states, counting modal ratings across objectives, weighting state counts by student population) and qualitative analyses (such as identifying Missing and Extra Content through examination of reviewers' comments).

The project's five-member **Technical Advisory Committee (TAC)** was convened on March 21, 2018 to review preliminary results and provided guidance on further analysis and reporting, which was then incorporated into analyses. Work following the TAC meeting has also included completing analyses that were still underway, including searching other subjects' standards for Missing Content and completing reliability analyses.

NEXT STEPS

The next step of the project is to finalize the project reports, including a content coverage narrative and a methodological narrative. The content coverage narrative overlaps greatly with the presentation of key findings at the May 2018 Governing Board meeting.

MILESTONES

The major milestones of the project are summarized below.

Milestone	Estimated Timing
Obtain and verify mathematics standards	8/25/17 – 11/1/17
Convene TAC for guidance on draft analysis and reporting plan	10/5/17
Draft and finalize analysis and reporting plan	8/25/17 – 10/31/17
Prepare initial comparison documents	10/13/17 – 12/31/17
Train the CRC	12/6/17
Independent rating/review by CRC	12/7/17 – 1/15/18
Aggregate and compile ratings	1/8/18 – 1/31/18
In-person consensus meeting	2/6/18 – 2/8/18
Consolidate state standards and identify "missing" content	2/9/18 – 3/5/18
Obtain other subjects' standards and search for "missing" content	1/20/18 – 4/15/18
Analyze data for preliminary results	2/9/18 – 3/5/18
Convene TAC for analysis and reporting based on preliminary results	3/21/18
Complete data analyses	3/22/18 – 4/15/18
Prepare report of findings	3/22/18 – 5/30/18
Present findings at quarterly Board meeting	*5/18/18*

NAEP ASSESSMENT OF MATHEMATICS

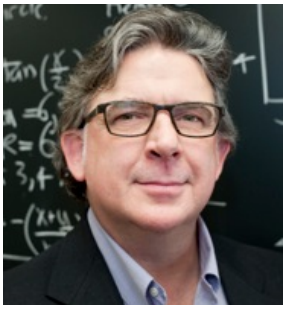
The Assessment Development Committee (ADC) welcomes distinguished mathematics experts for a discussion about the NAEP Mathematics Framework. Their expertise represents teachers, scholars, and state curriculum directors as leading voices. Each expert will summarize whether NAEP assessment of mathematics as outlined in the NAEP Mathematics Framework should be changed, before inviting questions from the Committee. Board member and resident mathematics expert Dale Nowlin will moderate. Panelists' bios are below, followed by milestones for the framework. Papers from each expert are attached, summarizing their perspectives.

Dale Nowlin
Moderator & ADC Member
Teacher & Mathematics Department Chair,
Bartholomew Consolidated School Corporation

Zalman Usiskin
Professor Emeritus
University of Chicago
Director, University of Chicago School Mathematics Project

Kevin Dykema *via video*
Teacher
Mattawan (MI) Middle School

Gladis Kersaint *via video*
Dean & Professor
University of Connecticut



William McCallum *via video*
Professor
University of Arizona

Diana Suddreth *via video*
Director of Teaching and Learning
Utah State Board of Education

BIOGRAPHIES

Zalman Usiskin is a Professor emeritus of education at the University of Chicago. He continues at the university as director of the University of Chicago School Mathematics Project (UCSMP), a position he has held since 1987. His research has focused on the teaching and learning of arithmetic, algebra, and geometry, with particular attention to applications of mathematics at all levels and the use of transformations and related concepts in geometry, algebra, and statistics. His interests are broader, covering all aspects of mathematics education, with particular emphasis on matters related to curriculum, instruction, and testing; the selection and organization of content; comparison studies of students using different curricula; international mathematics education; the history of mathematics education; and educational policy.

Zalman has authored or co-authored over 150 articles and papers on mathematics and mathematics education, and dozens of books, including textbooks for grades 6 through 12. In developing these books, he taught mathematics in nine secondary schools. He also co-authored a mathematics text for graduate students on high school mathematics. From 2004 to 2015, he was a co-PI of the Center for the Study of Mathematics Curriculum. In 2014, the National Council of Teachers of Mathematics (NCTM) published a book of 38 of his papers.

Zalman's service includes terms on the Mathematical Sciences Education Board of the National Research Council, the Board of Directors of NCTM, and the United States National Commission on Mathematics Instruction, which he chaired from 1998 to 2001. From 1995 through 2005, he was on various NAEP committees associated with development and evaluation of NAEP items, including development of the NAEP Mathematics Framework.

Zalman has received a national leadership award from the National Council of Supervisors of Mathematics and lifetime achievement awards from NCTM and the International Society for the Design and Development of Education. He holds bachelor's degrees in mathematics and education from the University of Illinois, an M.A. in teaching from Harvard University, and a Ph.D. from the University of Michigan in curriculum and instruction.

Kevin Dykema is an energetic teacher and presenter who has a passion for mathematics. He has taught 8th grade math for the past 22 years and is currently teaching at Mattawan (MI) Middle School. He also conducts many professional development sessions throughout the United States on the use of manipulatives in the math classroom. Kevin believes that manipulatives are a great way for students to develop conceptual understanding of the math. He has written several how-to books on teaching mathematics using manipulatives, and has served as editor and referee for the journal Mathematics Teaching in the Middle School.

Kevin was awarded the Michigan Council of Teachers of Mathematics Regional Director's Award in 2007 for outstanding contribution and leadership in mathematics education as

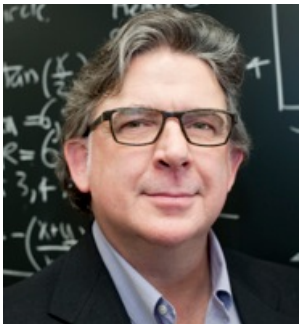
well as the Service Award in 2014. He has served as a regional director for the organization and was the annual conference chair from 2011-2016. He also co-founded a conference focused on mathematics for students with disabilities, which he has co-chaired since 2015. Kevin is honored to serve a 3-year term on the National Council of Teachers of Mathematics Board of Directors, which began in 2016.

Kevin has a B.A in Mathematics from Calvin College and a M.A. in Mathematics Education from Western Michigan University.

Gladis Kersaint is Dean and Professor of Mathematics Education at the University of Connecticut, Neag School of Education. Gladis previously served as the associate dean of academic affairs and research and professor of mathematics education for the College of Education at the University of South Florida (USF). There, she served as director of the David C. Anchin Center and held the David C. Anchin Endowed Chair in Education Innovation. She also served as coordinator of USF Undergraduate Education and chair of the General Education Council. Prior to her academic post at USF, Gladis taught high school mathematics for the Miami Dade County Public Schools.

Gladis has an extensive publication and national and local service record. She has published four books and numerous refereed journal articles related to factors that influence mathematics teacher education and effective mathematics teaching, the mathematical teaching and learning of at-risk students, and the use of technology in teaching and learning mathematics. During her tenure at USF, she served as the principal or co-principal investigator of approximately $30 million of National Science Foundation, U.S. Department of Education, and Florida Department of Education grants.

Gladis has led a number of collaborative STEM education projects involving school district personnel along with university faculty in Arts and Sciences and Engineering. Her national service includes being a member of the Board of Directors for the National Council of Teachers of Mathematics and the Association of Mathematics Teacher Educators. Gladis holds a B.S. in Mathematics and an M.S. in Education from the University of Miami, as well as a Ph.D. in Mathematics Education from Illinois State University.



William McCallum is a University Distinguished Professor of Mathematics at the University of Arizona. Born in Sydney, Australia in 1956, he received his Ph.D. in Mathematics from Harvard University in 1984, under the supervision of Barry Mazur. After spending two years at the University of California, Berkeley, and one at the Mathematical Sciences Research Institute in Berkeley, he joined the faculty at the University of Arizona in 1987. In 1989 he joined the Harvard calculus consortium, and is the lead author of the consortium's multivariable calculus and college algebra texts. In 1993–94 he spent a year at the Institut des Hautes Etudes Scientifiques, and in 1995–96 he spent a year at the Institute for Advanced Study on a Centennial Fellowship from the American Mathematical Society. In 2005 he received the Director's Award for Distinguished Teaching Scholars from the National Science Foundation. In 2006 he founded the Institute for Mathematics and Education at the University of Arizona, and is currently

its director. In 2009–2010 he was one of the lead writers for the Common Core State Standards in Mathematics. His professional interests include arithmetical algebraic geometry and mathematics education. He has received grants and written articles, essays, and books in both areas.

Diana Suddreth is the Director of Teaching and Learning at the Utah State Board of Education where she currently leads the Utah Teacher Effectiveness Team, The Standards Implementation Teams, the Digital Teaching and Learning Team, and Utah Educator Licensing. Although her professional role has grown to encompass all academic content areas, her passion remains for high quality mathematics education for all students.

Diana began her 25-year teaching career in Las Vegas, Nevada, and ended it in Southern Utah with stops in California and Northern Utah along the way. Diana was the 2000 Presidential Awardee in Secondary Mathematics for Utah and earned her National Board Teaching Certificate in Adolescent and Young Adult Mathematics in 2002. While teaching, Diana was the recipient of several grants, including the Toyota TIME grant which she focused on building a statistics library and resources for her high school.

Diana joined the Utah State Board of Education in 2006 as Secondary Mathematic Specialist and was also the STEM Coordinator for five years before becoming director. She led the state in transition to an integrated pathway of the Utah State Core based on the Common Core. Her activities in the mathematics education community include serving two years as the President of the Association of State Supervisors for Mathematics and working with the Mathematics Teacher Education Partnership.

NAEP MATHEMATICS FRAMEWORK MILESTONES: PAST & FUTURE

- **2000**. Panels were convened to update the NAEP Mathematics Framework. Outreach before the project launch suggested that needed revisions did not require an entirely new framework to replace the previous framework. Therefore, no disruption to NAEP trend reporting was anticipated.
- **2001**. Board adopted the current NAEP Mathematics Framework.
- **2006**. Board adopted modifications for the 12th grade to pave the way for NAEP reporting on academic preparedness for college and job training. 2005 results were reported with continued student achievement trends for grades 4 and 8 extending back to 1990. A new trend line for grade 12 began, extending from 2005 onward.
- **August 2017**. ADC completed Framework Development Policy revision, and commissions comparison study to review mathematics standards across the country.
- **November 2017**. ADC discussed strategies for upcoming framework update projects.
- **May 18, 2018.** ADC is briefed on the mathematics standards review results addressing all 50 states and invites mathematics experts to share comments and recommendations on the NAEP Mathematics Framework. These will be used to assist the Committee in preparing a content recommendation to the Board regarding the framework.
- **June – July 2018.** ADC deliberates next steps for the NAEP Mathematics Framework and develops a recommendation to the full Board regarding the scope of the framework update that shall be conducted.
- **August 2018**. The Board takes action on the Charge to the Visioning and Framework Development Panels that will be convened. The NAEP Mathematics Framework Update project launches with a Fall 2018 Visioning Panel Meeting.

External Reviews of

The Mathematics Framework for the 2017 National Assessment of Educational Progress

Prepared by:

Kevin Dykema

Gladis Kersaint

William McCallum

Diana Suddreth

Zalman Usiskin

April 2018

Table of Contents

External Reviews of

The Mathematics Framework for the 2017 National Assessment of Educational Progress

The National Assessment Governing Board recruited five experts in mathematics to review *The 2017 Mathematics Framework* and provide recommendations regarding revisions needed for the NAEP Mathematics Framework to reflect current research and knowledge in mathematics, mathematics instruction, learning mathematics, and assessment of mathematic concepts. The experts are:

- Kevin Dykema, Eighth Grade Mathematics Teacher, Mattawan Middle School (Michigan) and National Council of Teachers of Mathematics Board Member
- Gladis Kersaint, Dean and Professor, University of Connecticut, Neag School of Education
- William McCallum, Professor, University of Arizona and President, Illustrative Mathematics
- Diana Suddreth, Director of Teaching and Learning, Utah State Board of Education
- Zalman Usiskin, Professor, Emeritus, The University of Chicago and Director, The University of Chicago School Mathematics Project

The experts submitted their recommendations in writing. Those recommendation papers are included in the following pages. They will present their recommendations and participate in a discussion with members of the Assessment Development Committee (ADC) on Friday, May 18, 2018 during a *Panel Discussion: NAEP Assessment of Mathematics* at the National Assessment Governing Board's May quarterly meeting in Montgomery, AL. Dale Nowlin (ADC Member) will facilitate the discussion.

****** DISCUSSION DRAFT ******

Time for Revision: Updating the Framework to Stay Current

Kevin Dykema

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 (CCSS), there is little doubt that most states either use those standards or have created their own standards that very closely model the CCSS. 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 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 (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 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 on NAEP.

The biggest example of this omission occurs in 8th grade. Solving systems of equations, both graphically and algebraically, are included in 8th grade state standards, but don't get assessed until 12th grade on NAEP. In fact, solving systems of equations (as well as work with linear equations) is one of the three major focal areas for the 8th-grade CCSS. 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 the procedural fluency. 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 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 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 as the vast majority of the existing framework 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. However, assessment experts would have to be consulted to determine the feasibility of maintaining trend following changes to the framework.

References

Cohen, J. (2012). The Common Core State Standards: Where do probability and statistics fit in? *The Statistics Teacher Network, 79,* 2-5.

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Hughes, G.; Daro, P.; Holtzman, D.; & Middleton, K. (2013). *A study of the alignment between the NAEP Mathematics Framework and the Common Core State Standard for Mathematics (CCSS-M).* Washington, DC: American Institutes for Research.

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Review of the NAEP Mathematics Framework

Gladis Kersaint

I was asked to review the *Mathematics Framework of the 2017 National Assessment of Educational Progress (*referred to as *Mathematics Framework*, hereafter) and answer the following questions: Does the NAEP Mathematics Framework need to be revised? If so, why and how? As stated in the document, the framework "lays out the basic design of the assessment by describing the mathematics content that should be tested and the types of assessment questions that should be included" (p. 2). Although the NAEP Mathematics Framework is not intended to represent any particular curriculum or what is taught, I reviewed the content of the *Common Core Standards for Mathematics* and the *Guidelines for Assessment and Instruction in Statistics* to ground my thinking in current expectations for K-12 students. I believe the anticipated review of curriculum standards across the nation conducted by the Governing Board will provide additional insights from the field, represented by state curriculum documents, about what students should know and be able to do by grades 4, 8, and 12. Information from this review is not yet available, and as a result, was not taken into consideration.

As I read each of the chapters of the *Mathematics Framework*, I asked myself the following questions: Does this chapter do what it is intended to do? Are clarifications needed? If so, what? Is anything missing? Does it reflect current understandings/interpretations in the field? In what ways might the field benefit from a revision of the document? As I attempted to answer these questions, I maintained focus on the intent of the assessment framework as described earlier. Below I provide conclusions drawn after reading each chapter of the NAEP Mathematics Framework. In some cases, I provide examples to illustrate what is meant.

Chapter One: Overview

Chapter 1 provides a historical overview of the development of the framework and the changes that were made overtime. It outlines the intent of the assessment framework, clarifies what it is and what it is not; provides context for the changes that were made; and provides an advance organizer for the types of information to be provided in the remainder of the document. I wondered if the first chapter could include summary information about the administration of the test and the tools available to test takers during its administration (e.g., manipulatives and calculators, etc.). Although this information is discussed in Chapter 5, it might be helpful to have this information as one reads some of the objectives discussed in Chapter 2. For example, when I read "…use appropriate measurement instrument..." for Grade 4, I wondered how that objective would be addressed as part of the assessment. Because this is clarified in Chapter 5, I present it here as something to consider rather than a change that must be made.

Chapter 2: Framework for the Assessment

"This chapter presents the content areas, distribution of items by content, a description of the matrix format, and a detailed description of each content area followed by the specific objectives of the mathematics framework for that area" (p. 5). Overall, the broad areas of mathematics content (Number Properties and Operations; Measurement; Geometry; Data Analysis, Statistics, and Probability; and Algebra) continue to be relevant and the objectives identified for grades 4, 8, 12 are clear and account for expected growth of knowledge across the grade levels. I believe the addition of mathematical reasoning that first appeared in the 2005 framework is an important one. I did not note any gaps or missed content for consideration. Therefore, I am not recommending any changes to the subject matter content addressed in the Mathematics Framework.

Chapter 3: Mathematical Complexity of Items

Chapter 3 describes the three levels of mathematical complexity of items (e.g., low, moderate, or high), which describes the cognitive demand associated with specific test items This section includes sufficient information to understand the intent and focus of each of the complexity levels and includes examples to clarify why items are labeled as they are. I have no recommended major changes to this section. However, I highlight a minor editorial suggestion for a sentence in the rationale section of Example 11 (p. 44).

- Current statement: "At grade 8, students have not learned a procedure for answering this type of question."
- Proposed revisions bolded: "At grade 8, students **might not** have ~~**not**~~ learned a procedure for answering this type of question."

I am noting this statement because I found it to be substantively unlike the other statements made in this section because it implied definitive knowledge about what students at a particular grade have not learned. I am suggesting the use of tentative language to acknowledge the increasing number of students who are enrolled in the equivalent of a high-school Algebra 1 course in grade 8 who may have greater exposure to this type of reasoning.

Chapter 4: Item Formats

Chapter 4 describes the item formats (multiple choice, short constructed response, and extended constructed response) that continue to be appropriate for the assessment. However, it is important to acknowledge that the use of a digital platform may provide different options for item formats, which include multi-select items, grid items, table items, or equations as is used in other digital assessment platforms such as those used by *Smarter Balanced Assessment*

Consortium (SBAC) or *Partnership for Assessment of Readiness for College and Career* (PARCC).

The examples and the scoring guide adequately clarify the intent of each type of format and how assessment items are scored. However, all examples illustrated in this section reflect the types of questions found on a paper-pencil type of exam. Because the NAEP assessment will be administered in a digital environment with dynamic capabilities, it should include examples that highlight the assessment tools and the dynamic options that will be available as well as the various ways available to provide a response. For example, the grade 4 and grade 8 sample items from SBAC shown in Figure 1 provide some indication of the features that will be available during the example.

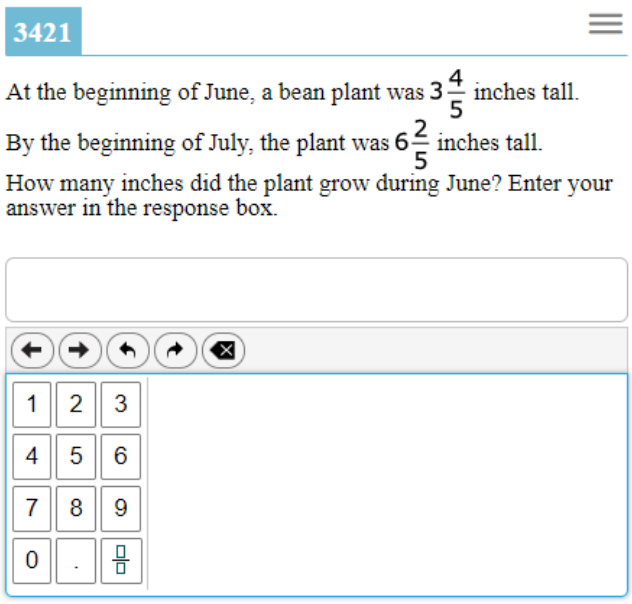

Figure 1. Sample Items from Smarter Balance Assessment.

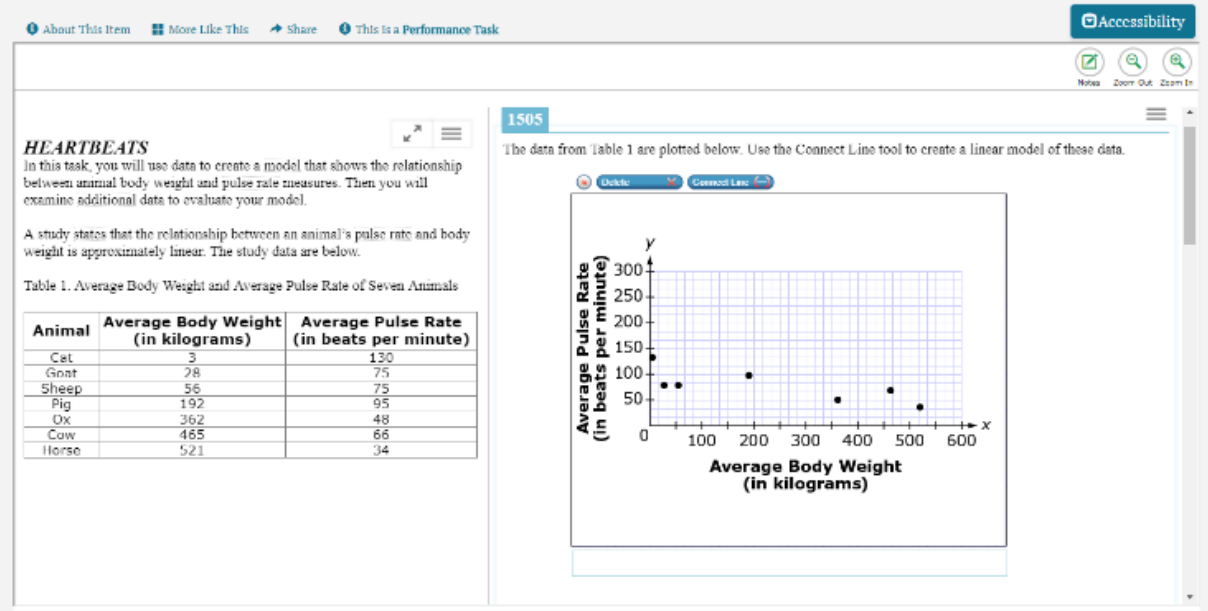

Figure 1 *cont'd*. Sample Items from Smarter Balance Assessment.

Chapter 5: Design of Test and Items

Chapter 5 describes the guidelines for balancing a number of factors, "including content, level of complexity, and format" (p. 4). Overall, I found the balance of content, mathematical complexity and item formats to be appropriate, therefore I am not recommending changes in those areas.

Calculators and Manipulatives. If the digital assessment will permit students to use virtual tools (e.g., calculator, manipulatives), it will be important to include examples to show the types of online calculators that will be available as was suggested in the previous section (see Figure 1).

Accessibility. This section currently states that the "exam provides accommodations for students with special needs" (p. 66). I believe this is a limited perspective given the use of a digital platform, which may permit different options for making the exam accessible. I

recommend the use of a universal design, which allows accommodations that are typically made available for a specific group to be available to all test takers. Then, accommodations can be identified for specific situations that cannot be addressed within the digital platform (e.g., the need to administer the test in an alternative location). For example, screen readers (i.e., text to speech) can be made available to all students, including students who are not identified with specials needs such low-ability readers, without compromising the integrity of the mathematics content to being assessed. Also, with the availability of online translators, it might be possible to offer primary or home language translations of the test content beyond the focus on Spanish.

Overall, this section should reflect the nature of the technological tools that are available on the digital platform and highlight how these features provide access to all students, including those with specific special needs. This shifts the focus to the accessibility of the exam for all students and away from the types of students who might receive particular accommodations.

Comments the 2017 NAEP Framework for Mathematics

William McCallum

Shifts in state standards since 2005

The content expectations in the NAEP framework at grades 4 and 8 have remained essentially unchanged since 2005, and at grade 12 since 2006. During that time there has been significant change in state standards, starting with Achieve's *American Diploma Project*, through the 2010 Common Core State Standards in Mathematics (CCSS-M), and continuing today.

From confusion to consensus. In 2005, the distribution of grade levels at which a given topic was addressed across different state standards was extremely wide. For example, the grade in different state standards at which students begin to add and subtract fractions ranged from 1 to 7, with solid pluralities in grades 3, 4, and 5 (Reys, 2006). Today, the approximately 40 states that have adopted CCSS-M or similar standards place this expectation at grade 4, the same grade as NAEP. In 2006, states had standards on proportions ranging from grades 3 to 8 (Reys, 2006). Now there is solid agreement that proportions start in grade 6 or 7, whereas in NAEP they are on the grade 4 assessment (Achieve, 2016). The state consensus has led to focus on the most important mathematics for each grade level.

From strands to structure. Most standards in the mid 2000s were organized by strands that spanned all grades from kindergarten to grade 12, such as number, measurement, geometry, and algebra. This arrangement, allowing for algebra all the way back to kindergarten and number all the way to grade 12, gave license to the mile-wide-inch-deep curriculum in which we "introduce topics early and then repeat them year after year" (Schmidt, Houang, & Cogan, 2002). In contrast, most state standards today follow progressions in which one topic leads to another,

with, for example, a focus on arithmetic in grades K–5 leading to a focus on algebra in grades 6–8. Furthermore, standards within a topic are often arranged in conceptually-related clusters, which "helps to maintain coherence, ensures that standards are related, and discourages the inclusion of disconnected skills" (Achieve, 2016).

Balance of procedural fluency, conceptual understanding, and applications. During the 90s and early 00s, debate raged about which of these three was the appropriate foundation for a sound mathematics education, contributing to sudden swings in state standards. In its final 2008 report, the National Mathematics Advisory Panel (NMAP) called for an end to this false trichotomy: "To prepare students for Algebra, the curriculum must simultaneously develop conceptual understanding, computational fluency, and problem solving skills. Debates regarding the relative importance of these aspects of mathematical knowledge are misguided" (NMAP, 2008). CCSS-M embraced this balance, which persists to this day in state standards.

Implications for NAEP

Because NAEP is constrained by what is actually happening in classrooms, the previous confusion of state standards necessarily showed up in the NAEP assessment framework. The current consensus makes possible a more focused assessment than was possible in 2005. Furthermore, it allows for greater specificity for item developers. Hughes, Daro, Holtzman, and Middleton (2013) noted the lack of specificity in certain areas as a problem.

The shift to more focused and coherent standards has caused some misalignment between NAEP and the states, both in testing things that are not taught, and in not testing things that are taught. For example, the number line, an important tool for understanding fractions, is underemphasized in grade 4 NAEP relative to state standards (Hughes et al., 2013). In grade 8 NAEP, solving

systems of linear equations is absent, whereas it is an important topic at grade 8 in current state standards (Hughes et al., 2015). On the other hand, NAEP, following the strand model, tests many topics inappropriately early, for example patterns, medians, and proportional relationships in grade 4. For a comprehensive list, see Zimba (2015). As a result of these misalignments, NAEP may not be capturing educational progress accurately.

An important dimension of NAEP is the classification of items into low, medium, and high mathematical complexity. Placing too many topics early could confound this classification. To quote the 2017 NAEP framework, "The demands on thinking that an item expects—what it asks the student to recall, understand, reason about, and do—assume that students are familiar with the mathematics of the task."

The approach to algebra in NAEP does not reflect the current approach in CCSS-M, and is therefore at odds with standards in most states. Compared to these standards, grade 4 NAEP pays less attention to conceptual basis for algebra in properties of operations; no attention to number line interpretation of fractions or understanding fractions as quantities; and no attention to the role of place value in ordering and comparing whole numbers, or to the importance of attending to the whole in ordering and comparing fractions (Hughes et al., 2013). At grade 8, the balance found in CCSS-M between expressions, equations, and functions is not well reflected in NAEP (Hughes et al., 2013).

Finally, we note that the level of modeling complexity in current state standards for high school is not reflected on grade 12 NAEP.

Recommendations

From the point of view of content alignment there is a clear case for revising the NAEP framework. We recommend:

1. A move away from the strand model to an organization that takes account of the progression of domains in K–12 mathematics and that groups standards in conceptually-related clusters. The corresponding change in reporting could give more specific information than currently available, for example on students' skills in multi-digit computation in grade 4.

2. Address obvious topic mismatches as noted in recent alignment studies.

3. Increase the specificity of the framework in areas where overly broad standards provide insufficient guidance to item developers, for example in grade 8 algebra.

4. Raise the level of modeling complexity in the high school standards.

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*** ***DISCUSSION DRAFT*** ***

NAEP Framework Response

Diana Suddreth

The *2017 NAEP Mathematics Framework* lays a respected foundation for assessing student knowledge in mathematics at grades 4, 8, and 12 and is a useful portrait of trends in student abilities; however, there are considerations that should be addressed in the revision of the framework to better represent current research and practice regarding student learning.

The NAEP assessment is highly valued in many states to measure progress over time and assess local standards, programs, and student achievement. As the National Assessment Governing Board considers changes to the framework, they should also assess how the continuity of reporting can be maintained so that researchers and policy-makers can make connections to previous years, policies, and practices.

A primary consideration for change must be linking the framework to current research and practice while eliminating anachronistic material. Citations in the 2017 NAEP framework are mostly from the turn of the 21st Century, ignoring advancements such as the Common Core State Standards (CCSS), the Guidelines for Assessment and Instruction in Statistic Education (GAISE), the Guidelines for Assessment and Instruction in Mathematical Modeling Education (GAIMME), and the national focus on Science, Technology, Engineering, and Mathematics (STEM). These advancements, along with research about how children learn mathematics must be attended to in the next revision of the NAEP framework.

Even though every state has not adopted the CCSS, the development of the standards and their widespread implementation, coupled with agreement about learning trajectories, have resulted in

an era where states agree regarding placement of most topics in mathematics. Even states who have not adopted the CCSS have adjusted timelines so that students across the United States experience many of the same topics at the same grade level. Furthermore, state standards across the United States have placed ever more emphasis on reasoning and modeling with mathematics to solve problems. Although this paper is too short to give a comprehensive accounting of potential issues with the current framework, a few examples will illustrate the point.

The current NAEP framework recognizes geometry as an essential topic in mathematics; however, it does not capture the academic importance of transformational geometry at the appropriate ages. Transformations are an important facet of developing concepts of congruence and similarity so that students can not only identify aspects of geometry, but also justify them. No more are transformations the "flips," "turns," and "slides" in the current framework, but rather the building blocks of "reflections," "rotations," and "translations." As such, what could previously be assessed in 4th grade, must now be assessed in 8th grade where these concepts are established. The precise language of mathematics supported in the CCSS and in state standards can and should be used in eighth grade where these ideas are developmentally appropriate.

Statistics is another area where framework writers must look at new research. The GAISE Standards informed the CCSS and as a result there has been considerable movement in the study of statistics. Probability and measures of central tendency are no longer topics in elementary school. Fourth grade items should be limited to bar and picture graphs while eighth grade may include more sophisticated data displays.

As a final illustration, authors should consider learning trajectories for proper placement in the framework. The current framework assesses proportionality in 4th grade, yet 4th grade students

are just solidifying their knowledge of rational number and will not fully understand proportionality until 8th grade. The topics in the framework are important, but the result of states aligning expectations to research is that not all topics are placed at the appropriate level.

No doubt placement of specific mathematics topics will be a challenge. Despite the CCSS and state efforts at alignment, there are still regional differences. One potential answer to this challenge is to provide students with more opportunities for modeling and problem solving throughout the assessment which will result in multiple entry points and multiple paths to solutions. State standards now emphasize reasoning, precision, and justification through communication. Ideally, NAEP would capture the results of efforts in these areas. Such items have been a strength of NAEP in the past and might be an area for further focus in the future.

In 2009, the NAEP Framework added a new topic of mathematical reasoning at grades 4, 8, and 12. While it is commendable that the NAEP assessment attends to mathematical reasoning, separating it from the content of mathematics gives a false sense that reasoning is somehow separate from number, data analysis, algebra or geometry. Mathematical reasoning is not a mathematical topic to be segregated from more traditional aspects of mathematics but is a tool to be used whenever approaching an unfamiliar mathematics problem. There may be some value in reporting on student abilities in mathematical reasoning, yet it is more important that reasoning permeate the assessment. Currently, important opportunities are lost. There should be many occasions for students to justify thinking in multiple areas not limited to geometry, and certainly not limited to recall of definitions or theorems. Students should be expected to justify their thinking in algebra, number, and probability and can do so either formally or informally if given a chance.

In addition to the content issues, the NAEP Framework authors could consider revision as an opportunity for other improvements. In writing introductory paragraphs regarding the history of mathematics, authors should take care to represent more than a Western approach. One cannot help but notice that Descartes is mentioned by name, yet Muhammad ibn Musa-al-Khwarizmi, the father of Algebra, is not. This omission leads one to wonder how equity issues are considered in the development of the assessment. A statement in the framework regarding the selection of contexts for mathematics that ensure equitable access would give notice that equity is attended to.

For the NAEP assessment to equitably assess student learning, the framework should also address current accommodations. While Spanish is the most common non-English language spoken by children in the United States and Spanish forms are helpful, there are many more languages spoken in schools today. In some states, languages other than Spanish are more common such as Ilokano in Hawaii. Accessible dictionaries in other languages could be a first step towards providing access for English Language Learners.

In addition, students with disabilities now have many more accommodations available to them than are included in the NAEP framework. Braille and assistive technology communication devices should be considered to accommodate access for more students. As equity is a priority for all of us, it is an area that NAEP could address more completely in the framework.

Another opportunity for increasing student access and interest in the assessment would be making more connections with other STEM fields. This could be explained in the introductory paragraphs where it could be clear that STEM contexts are an important way for students to show their ability to use mathematics in purposeful settings. This would result in a more

authentic assessment not only of mathematics itself but also as a tool to be used in many disciplines.

Many improvements could be realized by making a thorough analysis of the verbs used in the framework. Verbs such as "solve," "perform," and "evaluate" are important and should be balanced with verbs such as "construct," "model," and "justify." Use of technology, somewhat new to NAEP, enables the design of more robust items where students create quick constructions and models that bridge the world between selected and constructed response.

One further non-content suggestion would be to consider adding a "Below Basic" reporting category. This would align much better with how states typically assess students and recognizes the unfortunate reality that there are students who are not able to do what is expected of them, especially considering the increased rigor of the CCSS and newly adopted state standards. NAEP can help uncover pockets where these deficiencies are most profound and give states much needed data to inform resource acquisition and allocation.

There are many considerations for the Board in revising the NAEP framework, ranging from grade alignment, to research, to connections to other disciplines (STEM). If the NAEP framework is rewritten to consider content alignment with commonly accepted standards and trajectories, equitable access and equity in presentation, and attention to the practices of mathematics, it will continue to be the trusted report card that it currently is.

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Should the Current NAEP Mathematics Framework Be Changed - And, If So, Why and How?

Zalman Usiskin

To answer the question in the title of this essay, I consider five current major trends of mathematics in society in general, and in education in particular (numbered **[1]** through **[5]** below), and the implications of these for the current NAEP frameworks at grades 4, 8, and 12.

(1) The increasing importance of statistics and financial mathematics to the citizen and in careers. From understanding the variability of results of polls to the probabilities inherent in medical diagnoses, lotteries, and investments, today's citizen needs to be able to make decisions based on statistical information. Today's citizen needs to be familiar with the mathematics of loans and mortgages and long-term financial planning and, if the citizen is an investor, to understand the relationship between risks and rewards. The current NAEP framework creators had the foresight to allot 10% of the items at grade 4, 15% at grade 8, and 25% at grade 12 to data analysis, statistics, and probability.

> **Implication 1:** The *current* percents allocated to data analysis, statistics, and probability seem appropriate at all three grade levels. For what might be taught 10 or 15 years *in the future*, an argument might be made for increasing the grade 12 (and perhaps even the grade 8) allocations to 30% and 20%, respectively, but no greater.

(2) The increasing breadth of college-level applications of mathematics. A report of the National Research Council (NRC) describes this growth as follows: "Mathematical sciences work is becoming an increasingly integral and essential component of a growing array of areas of

investigation in biology, medicine, social sciences, business, advanced design, climate, finance, advanced materials, and much more" (NRC, 2013).

> **Implication 2:** K-12 mathematics, and thus future NAEP assessments need to cover groundwork not only for traditional calculus but also for important mathematics apart from calculus.

(3) The increasing availability of technology (computer, calculator, smartphone) that can *do* mathematics. Smartphones everywhere are equipped to do arithmetic computations. As a result, outside of school, paper-and-pencil computation has become virtually obsolete. In its place, on the job and in the marketplace, there is general recognition that mental arithmetic and estimation of reasonableness of answers are critical skills. Free or inexpensive dynamic geometry software can manipulate geometric figures; computer algebra systems can do all the symbolic algebraic manipulations that students have historically been expected to do by hand. Based on the current NAEP frameworks, in the 2017 NAEP assessment there exist items at all grade levels for which a student was expected to use a calculator: 4-function at grade 4, scientific at grade 8, and graphing calculators at grade 12. Also, estimation is one of the six components of the "number properties and operations" content area at all three tested grade levels.

> **Implication 3:** The current calculator policies should be maintained. More sophisticated technologies have not gained enough traction in classrooms to definitively warrant inclusion in NAEP, but a future-looking assessment – particularly because students are already taking NAEP on computers – might include items at grades 8 and 12 to test student ability to use and interpret results found by more sophisticated technology that does algebraic manipulations.

(4) The existence of the international studies Trends in International Mathematics and Science Study (TIMSS, since 1995) and Program for International Student Assessment (PISA, since 2003).[1] TIMSS involves 4th, 8th, and 12th-graders in the U.S. and is generally viewed as testing academic content much like NAEP. In contrast, PISA measures 15-year-olds on applying mathematics to real-world problems in real-world contexts. In 2015, 72 countries participated in PISA, 49 at 4th-grade TIMSS, 38 at 8th-grade TIMSS, and 9 at advanced TIMSS. The international studies have provided interesting benchmarks for U.S. student performance, but the reasons for the scores of the highest-performing countries involve far more than curriculum (Usiskin, 2012).

> **Implication 4:** The growing breadth and importance of mathematical applications, as mentioned in (1) and (2) above, bolstered by the international popularity of PISA, suggests that adding a PISA-like domain of mathematical literacy to domains in the current NAEP 12th-grade framework should be considered.

(5) The widespread use of the CCSS-M (CCSSI, 2010) and state-level variants, state tests, and guidelines for publishers (www.corestandards.org, 2012, 2013). Although U.S. Secretary of Education Betsy DeVos declared that the Common Core is dead (U.S. Department of Education, 2018) and will receive no funding at the national level, the CCSS-M remain powerful determiners of what is taught in almost all states. With only a few exceptions, all states have curricula that follow or closely emulate the Common Core, and the "state-specific editions" of popular textbook series in grades K-8 are typically the "Common Core edition" modified to handle discrepancies in individual states and without identification of standards in non-Common Core states. However,

[1] A history of U.S. participation in international studies can be found in Dossey, McCrone, & Halvorsen (2016), pp. 67-86.

Secretary DeVos's declaration reflects significant dissatisfaction with the Common Core on many fronts, and not just from political conservatives. As Behuniak (2015) noted in a NAEP validity study, "The reduction of state participation in SBAC and PARCC, combined with the increasing discontent with the CCSS, significantly increases the likelihood that NAEP will continue to serve as the nation's report card for the foreseeable future."

> **Implication 5a:** The Common Core has a questionable future, and for this reason any move of NAEP towards the CCSS-M should be minor.

The CCSS-M standards are by individual grade for each of the grades K-8, because the CCSS-M were designed with the goal of testing at each grade from grades 3-8 in mind. So, the CCSS-M provides a year-by-year sequence of instruction in each area of its standards. Because the NAEP tests are given only at grades 4 and 8, the NAEP frameworks should not focus on the sequence of instruction but continue to focus on the final product.

> **Implication 5b:** The greater detail of the CCSS-M is necessary in part due to testing at each grade and does not constitute a significant consideration for changing anything in the NAEP frameworks at either grade 4 or grade 8.

The intent of the CCSS-M authors was to deliver a "more focused and coherent curriculum" (CCSSI, 2010). Consequently, the guidelines for publishers to strip their programs of content not directly associated with a Common Core standard at that grade. Teachers and teaching materials are judged by their adherence to the CCSS-M with reluctance to include anything that is not a recognizable standard (for criteria, see www.corestandards.org, 2012, 2013, https://www.edreports.org/about/index.html). Furthermore, the CCSS-M discourage putting students in algebra in grade 8 and calculus in grade 12. The result is that students receive a

curriculum that is purposely deeper but narrower in breadth. This is particularly true in grades K-4, where the CCSS-M have no statistics, less algebra, and less geometry; in all of K-8, where there is no mention of calculators (and there is an increase in paper-and-pencil computation with decimals from what most states had in their earlier standards); and in grades 9-12, where the CCSS-M identify a curriculum that is aimed at calculus and does not cover those students (likely a majority, even in the future) who will not need calculus for their careers, whereas NAEP frameworks are designed for the mathematics needed by all students.

Implication 5c: The NAEP frameworks should remain broader than CCSS-M at all levels.

Although Daro, Hughes, and Stancavage (2015) suggested that the Governing Board add content to the grade 8 NAEP framework to bring it in agreement with the CCSS-M, there are reasons that would be unwise. Fundamental among these is that there exists little data to indicate that the CCSS-M have improved mathematics performance – even on tests designed specifically to cover the Common Core (Loveless, 2018; SBAC, 2018). Moving the NAEP Frameworks towards the Common Core would constitute an endorsement of a curriculum that has not proved itself even with ample opportunities throughout the nation for such proof. In each of the states, data exist to indicate whether the Common Core or other standards are being reached in that state, and to determine whether student performance has improved or not; in each state an independent broader-based assessment is exactly what is needed to counter the narrowness of the CCSS-M. NAEP presents the only ongoing national evaluation that can compare current performance with performance before 2010 (see, e.g., Loveless, 2018).

Implication 5d: Bending NAEP frameworks to the CCSS-M Standards would cause unnecessary redundancy in testing, lessen opportunities for historical comparisons, and

serve to stifle attempts to update the mathematics curriculum in the U.S. to reflect the changes in mathematics noted at the top of this essay.

"Historically the NAEP frameworks have aspired to represent *the union of all the various state curricula while reaching beyond these curricula to lead as well as reflect*. As a result, NAEP often has pushed on the leading edge of what the nation's children know and should be able to do" (Hughes, Daro, Holtzman, & Middleton, 2013, emphasis mine). I hope that the Governing Board enables NAEP to continue this fine and valuable tradition.

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NEXT STEPS FOR ADC FRAMEWORK ACTIVITIES

The ADC develops recommendations for what NAEP should assess. By engaging a wide array of stakeholders, each NAEP framework details these recommendations, describing what students should know and be able to do in a subject area and what will be tested on NAEP. Framework panels review assessment trends internationally. The panels also make recommendations for what should be included in NAEP questionnaires to provide context on student achievement.

In balancing the factors that determine the content that is most important to assess, recent ADC discussions have focused on several issues that will inform recommendations for Board deliberation and action, which include:

- Optimal role of NAEP for each content area.
- Expected gains and losses for each framework decision.
- Extent to which current frameworks are flexible enough to adapt as needed to changes in the field.
- Whether to more deeply assess an existing content area or add new content areas.
- Whether streamlining of NAEP frameworks is an appropriate goal.
- How to be intentional about content overlap between different assessments, while fulfilling statutory requirements, e.g., biennial reading and mathematics assessment.
- Level of specificity most useful to policymakers, researchers, and educators.
- How to establish and maintain partnerships that highlight actionable aspects of results, e.g., teacher access to released NAEP items and contextual information.
- Consideration of how other countries think about changing what they assess.
- How future NAEP items will be a resource for the field.
- How Board and Committee priorities should be reflected in upcoming framework updates.

The Strategic Vision Implementation Activities Report across all Board committees is presented in the Executive Committee tab. A working draft of ADC's plan for future work is attached, reflecting overarching projects for informing educators, updating policies, and exploring new approaches. More detailed timelines are presented for the NAEP Mathematics and Reading frameworks, the first two framework projects planned. A summary of common elements for each framework project follows.

Next Steps

At the March 2018 Board meeting, the ADC will have an opportunity to discuss next steps to support upcoming activities and policy decisions, with particular emphasis on the NAEP Mathematics Framework and the ADC recommendation to be presented for Board action in August 2018.

WORKING DRAFT* PLAN: ALL ADC STRATEGIC VISION (SV) ACTIVITIES

ACTIVITY	START	FINISH	STATUS
Identify NAEP Resources & Information for Educators (*SV #3 Expanding NAEP Resources* and *SV #6 Contextual Variables*)	May 2017	Nov 2021	ADC discussed NAEP Questions Tool and contextual variables in 2017. Suggestions for new or refined NAEP resources can be shared with R&D for Board outreach. To be determined: when/how to develop ADC recommendations.
Update Framework Development Policy	Jun 2017	Mar 2018	ADC began revising policy in Summer 2017. Board discussion continued in November 2017. Board adopted the revised policy in March 2018.
Review & Update **Mathematics** Framework for 2025 Assessment	Jun 2017	Mar 2025[1]	State math standards review began in August 2017. Results will be available to inform May 2018 ADC Framework Review and Fall 2018 framework update project launch.
Review & Update **Reading** Framework for 2025 Assessment	Oct 2017	Mar 2025[1]	ADC Framework Review slated for March 2018 to inform development of recommendations for a Fall 2019 framework update project launch.
Explore New Approaches to Framework Update Processes (also *SV #8 International Assessments*)	Nov 2017	Aug 2023	The Board's Technical Services contractor is an opportunity for analyses exploring innovations in how NAEP assessment updates are implemented. Framework Update Projects will review other countries' assessment programs to inform frameworks, framework processes, contextual data, and reporting.
Update Item Development Policy	Aug 2018	Mar 2019	To begin in 2018.
Review & Update **Civics**, **Geography**, and **U.S. History** Frameworks (Depends on NAEP Schedule)	Mar 2018	May 2020	Discussion of outreach began in March 2018, with suggestions to develop options for the ADC to consider. Review of current NAEP item pools will also inform ADC recommendations.
Review & Update **Economics** Framework (Depends on NAEP Schedule)	Mar 2020	Aug 2021	Depending on ADC recommendations and Board Assessment Schedule decisions, Economics may or may not be a standalone project.
Review & Update **Science** and **Technology & Engineering Literacy (TEL)** Frameworks (Depends on NAEP Schedule)	Sep 2020	Nov 2022	Discussion of outreach began in March 2018, Tentative next steps: learn more about standards in NGSS non-adopter states and learn whether stakeholders view that some or all of the TEL subarea on Technology & Society addresses student achievement goals in Civics, Geography, U.S. History, or Economics.
Review & Update **Writing** Framework (Depends on NAEP Schedule)	Mar 2022	Aug 2023	Initial discussion regarding the Writing Framework in conjunction with the Reading Framework slated for Summer/Fall 2018.
Develop Content Descriptions for the Long-Term Trend Mathematics and Reading Assessments (*SV #7Long-Term Trend*)	TBD	TBD	March 2018 discussion called for content outlines to be useful for LTT deliberations and efforts to describe the knowledge and skills of lower performing students. Staff is preparing an implementation plan regarding how content outlines can be developed.

* All timelines are estimated. This draft will be updated based on Board policy decisions. All activities address *Strategic Vision Priority #5 Updating Frameworks*, unless otherwise noted.

[1] Timeline includes administering the assessment.

MATHEMATICS[2] FRAMEWORK: EXPECTED MILESTONES

Milestone	Status
Review Mathematics Standards[3]	To be completed in May 2018.
ADC Discussion with External Experts in Mathematics	Scheduled for May 2018, allowing the ADC to simultaneously review the Mathematics Standards report and engage mathematics experts.
ADC Recommendation for Updating Assessment	Based on May 2018 ADC discussion, the ADC will prepare a recommendation on the type of framework update needed, including a draft charge for the Visioning and Development Panels that will be convened. The recommendation would be presented for Board action in August 2018.
Board Action on Charge	
Framework Contractor Selection	A contractor will be selected by Summer 2018 to begin preparing and compiling resources for the Visioning and Development Panel meetings.
Trend Scan & Resource Compilation	
Panel Meetings (3 to 6)	After Board action on the charge in 2018, the Visioning Panel will be convened to begin the series of Visioning and Framework Development Panel meetings to prepare a draft framework. ADC will receive ongoing updates. The full Board will review the draft when public comment is being collected. The Development Panel will use Board and public feedback to finalize the draft for Board action.
Full Board Review & Public Comment	
Framework Draft Finalized	
ADC Final Review of Framework	
Board Action	Summer/Fall 2019.
Assessment Administered	The Board-adopted framework will be provided to NCES by 2019. After item development, the newly updated assessment would be administered in 2025.

[2] The mathematics framework project will be implemented by the same contractor as the reading framework project, with some staggering in the schedule.
[3] See Attachment F for a project update.

READING[4] FRAMEWORK: EXPECTED MILESTONES

Milestone	Status
ADC Discussion with External Experts in Reading	Scheduled for March 2018.
ADC Continues Outreach and Prepares Recommendation for Board Deliberation	Summer 2018 through Spring 2019.
Board/ADC Decision on Reading Framework Update	This includes anticipated Board adoption of a newly extended NAEP schedule of assessments, which is slated for Board action in March 2019.
ADC Recommendation for Updating Assessment	Based on ADC outreach and framework reviews, the ADC will prepare a recommendation on the type of framework update needed, including a draft charge for the Visioning and Development Panels that will be convened. Board action is slated for Spring 2019.
Board Action on Charge	
Framework Contractor Selection	A contractor will be selected by Summer 2018 to begin preparing and compiling resources for the Visioning and Development Panel meetings.
Trend Scan & Resource Compilation	
Panel Meetings (3 to 6)	After Board action on the charge, the Visioning Panel will be convened in Fall 2019 to begin the series of Visioning and Framework Development Panel meetings to prepare a draft framework. ADC will receive ongoing updates. The full Board will review the draft when public comment is being collected. The Development Panel will use Board and public feedback to finalize the draft for Board action.
Full Board Review & Public Comment	
Framework Draft Finalized	
ADC Final Review of Framework	
Board Action	Summer / Fall 2020.
Assessment Administered	The Board-adopted framework will be provided to NCES by 2020. After item development, the newly updated assessment would be administered in 2025.

Common Elements of Each Framework Update Project

Based on the revised Framework Development Policy, several milestones address all NAEP assessment framework projects. Framework update projects engage stakeholders and content experts to identify needed revisions, via subject-specific factors including:

- Evolution of discipline and implications for NAEP frameworks
- Relevance to students' postsecondary endeavors
- Student achievement trends in terms of contextual factors
- Digital-based assessment issues
- International content and measurement trends

[4] The reading framework project will be implemented by the same contractor as the mathematics framework project, with some staggering in the schedule.

MILESTONES: ALL FRAMEWORK PROJECTS

ADC Discussion with External Experts in the Subject Area(s)
ADC Recommendation for Updating Assessment
Board Action on Charge
Framework Contractor Selection
Trend Scan & Resource Compilation
Panel Meetings (3 to 6)
Full Board Review & Public Comment
Framework Draft Finalized
ADC Final Review of Framework
Board Action
Assessment Administered

As a first step, the ADC conducts a framework review, where content experts are invited to a Committee session to provide reflections on the state of the discipline and the extent to which the relevant NAEP framework should be updated. Studies and additional outreach is pursued, as needed, to inform the ADC's recommendation about the type of framework update that is required. Next, the ADC brings its recommendation to the full Board for approval. In the case of an anticipated framework update, the recommendation includes a charge to stakeholders who will serve on the panels convened to draft recommendations for the ADC's consideration.

After Board discussion of the ADC recommendation, the Board will take action on the charge. Concurrently, Board staff will identify a contractor to execute the framework update process.

The framework contractor will launch the project by identifying individuals to serve on the framework panels and by compiling and developing resources to support the meetings of these stakeholders. A subset of these resources will include the Governing Board's charge to the framework panels as well as documents used to inform the Board's development of the charge. The first meeting of stakeholders will be for the *Visioning Panel* to discuss the major issues to be addressed in the framework. A subset of the Visioning Panel will continue on as the *Development Panel* to develop an updated framework. This panel will also develop the recommended updates to the Test and Item Specifications, as well as the Contextual Variables.

The ADC monitors the framework contractor's work via regular project updates. A draft of the panels' recommended framework will be shared for full Board review and public comment, as well as review by the Board's Committee on Standards, Design and Methodology. This feedback will allow the Development Panel to address concerns and finalize the draft framework, specifications, and contextual variables for the ADC's final review and Board action. The adopted framework, specifications, and contextual variables are given to NCES to begin assessment development, piloting, and finally administration of the operational assessment based on the new framework.

Assessment Development Committee
Item Review Schedule
March 2018 – August 2018
Updated April 9, 2018

Review Package to Board	Board Comments to NCES	Survey/ Cognitive	Review Task	Approx. Number Items	Status
4/16/18	5/2/18	Cognitive	2019 Mathematics (4, 8) Operational (DI)	5-10	
5/2/2018	5/25/2018	Survey	2019 Science (4, 8, 12) Operational	30-40	
5/2/2018	5/25/2018	Survey	2019 Reading (12) Operational	15-25	
5/2/2018	5/25/2018	Survey	2019 Mathematics (12) Operational	30-40	
5/2/2018	5/25/2018	Survey	2021 Reading (4, 8) Pilot	30-35	
5/2/2018	5/25/2018	Survey	2021 Mathematics (4, 8) Pilot	35-40	
5/4/2018	5/25/2018	Cognitive	2021 Mathematics (4, 8) Pilot (DI)	300	
5/4/2018	5/25/2018	Cognitive	2019 Reading (4, 8) Operational (SBT)	2-4 tasks	
6/6/2018	6/27/2018	Survey	2022 Civics, Geography, U.S. History (8, 12) and Economics (12) Existing Pool Review	165	
6/13/2018	7/2/2018	Cognitive	2021 Reading (4, 8) Pilot (DI)	120	
7/18/2018	8/10/18	Cognitive	2019 Mathematics (12) Operational (DI)	TBD	
7/18/2018	8/10/18	Cognitive	2019 Reading (12) Operational (DI)	TBD	

7/18/2018	8/10/18	Cognitive	2019 Reading (12) Operational (SBT)	TBD	
7/18/2018	8/10/2018	Survey	2021 Writing (4, 8, 12) Pilot	70-90	
7/19/2018	8/10/2018	Cognitive	2021 Writing (4, 8) Pilot (DI)	18	
7/25/2018	8/10/18	Cognitive	2019 Science (4, 8, 12) Operational (DI)	TBD	
7/25/2018	8/10/18	Cognitive	2019 Science (4, 8, 12) Operational (ICTs and hHOTs)	TBD	

NOTE: "SBT" indicates Scenario-Based Task
"DI" indicates Discrete Item