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How Does *Everyday Mathematics* 4 (EM4) Prepare Students for High-Stakes Mathematics Assessments?

Each year, beginning in Grade 3, most students in U.S. public schools take a standardized mathematics achievement exam. Roughly half of the public school students in the country will take exams developed by one of two state assessment consortia: either the Partnership for the Assessment of Readiness for College and Careers (PARCC) or the Smarter Balanced Assessment Consortium (SBAC). Both of these assessments are based on the Common Core State Standards for Mathematics (CCSS-M). Other students will take exams developed or purchased by their individual states, which may sometimes include items developed by PARCC or SBAC.

This paper focuses on the PARCC and SBAC assessments because they are used by the largest groups of test takers. However, the great majority of states (43 at the time of this writing) use the CCSS-M for their state mathematics standards and even non–Common Core states often have standards that are similar in most respects to the CCSS-M. Thus the ideas discussed here apply to most state assessments.

In preparing students for standardized mathematics assessments, two important ideas must be kept in mind: *alignment* and *opportunity to learn*. A third important factor is a "*spiral*" *sequencing of content and review*, which is a fundamental feature of the design of *Everyday Mathematics*. Together they create the conditions necessary for preparing students for success on standardized mathematics assessments.

Alignment

If assessments are to accurately reflect what students have learned, there must be an alignment between what is assessed and what was taught. This includes aligning not only the topics taught but the relative emphases put on the different topics. In an ideal environment, there is perfect alignment between standards, curriculum, instruction, and assessments. Tests that do not align with what students have had the opportunity to learn may only partially reflect what students know; as one might expect, research indicates that students who receive classroom instruction that is aligned with an assessment perform better on that assessment (Schmidt and Maier, 2009).

EM4 and Alignment to Common Core Mathematics Tests. EM4 and the PARCC and SBAC assessments were built from the ground up using the same blueprint—the CCSS-M—so the Common Core, EM4, and PARCC and SBAC are all aligned. The alignment between EM4 and the PARCC and SBAC assessments is evident across several dimensions.

- *Content Coverage*. The most obvious alignment is in the content covered. The EM4 developers engineered their curriculum to faithfully translate the Common Core into a practical classroom program. PARCC and SBAC developers similarly wrote their assessments to reflect the content and practices of the CCSS-M. The major shifts required by the CCSS-M are embodied in EM4 and also in the PARCC and SBAC assessments.
- *Content Emphasis.* The developers of EM4 and the PARCC and SBAC assessments carefully considered the relative emphasis and importance of topics in the CCSS-M. PARCC and SBAC identified high-priority areas in the standards at each grade, sometimes called "major work" or "priority clusters." Roughly three-fourths of content covered on the the PARCC and SBAC exams focus on these topics (PARCC, 2015; SBAC, 2015). The EM4 authors intentionally engineered the curriculum to have the same priorities and emphases as the exams.
- *Mathematical Practices.* Both PARCC and SBAC signal their strong commitment to assessing students' competence with the mathematical practices, which are central to the CCSS-M, by dedicating a significant portion of their tests and thus of students' scores to test items that assess mathematical practices. With its explicit and extensive attention to the Standards for Mathematical Practice, including Open Response and Reengagement lessons in every unit, EM4 prepares students to perform well on those items.
- *Cognitive Demand.* The developers of the PARCC and SBAC exams paid special attention to raising the cognitive demand of the test items compared to more traditional tests. One of the most fundamental features of *Everyday Mathematics* has always been the routine incorporation of high-cognitive demand tasks.
- *Item Types.* The PARCC and SBAC assessments include a variety of item types, some of which are machine-scored and some of which hand-scored. The machine-scored items include both traditional multiple choice questions and items that use "drag-and-drop" technology or require students to create equations or fill in their answers. Even the multiple choice items are enhanced, with some items allowing for more than one correct answer. Recognizing that students will need practice with these types of questions, the EM4 authors included similar questions in the Math Boxes for each lesson. This includes drag-and-drop items in the digital Student Journals and in Geometer's Sketchpad® activities.

Opportunity to Learn

Among the most established principles in education is that what students learn is related to what they are taught. Students are only able to learn what they have the opportunity to learn. Schmidt and Maier's analysis of multiple studies concluded that opportunity to learn is "perhaps the single most important factor related to school learning" (Schmidt and Maier, 2009).

EM4 and Opportunity to Learn. Providing students with the *opportunity to learn* the content and practices that are assessed by PARCC and SBAC depends on what teachers do each day in their classrooms. Because of its alignment with the PARCC and SBAC assessments, EM4 matches students' opportunities to learn with what they need to succeed on the assessments.

The way EM4 addresses the CCSS-M Standards for Mathematical Practice presents a special case of students having the opportunity to learn. A significant portion of the PARCC and SBAC assessments involves open response items, where students are asked to demonstrate a solution strategy and explain and justify their answers. These "performance tasks" are designed to help assess students' proficiency with the Standards for Mathematical Practice, along with their proficiency with mathematics content. The Open Response and Reengagement (ORR) lessons in EM4 were developed for the same purposes. Research by the Silicon Valley Mathematics Initiative (SVMI), based on more than 13 years of student data from open response performance tasks, found a strong correlation between students' exposure to the performance tasks and their performance on a state mathematics assessment. They also identified a large group of students who were deemed proficient on the state assessment but who performed poorly on the open-response performance tasks (Paek & Foster, 2012). In other words, regular use of the ORR lessons can improve students' overall mathematics performance on standardized mathematics assessments. Moreover, unless students have regular exposure to challenging, open-response tasks, such as the ORR lessons, they will likely not perform well on the performance tasks, which comprise a major portion of the weighted scoring on the PARCC and SBAC exams. Implementing the ORR lessons in EM4 provides students with the opportunity to learn important content and practices that make up a big portion of their scores of the PARCC and SBAC assessments.

EM4's Spiral Design and Standardized Mathematics Assessments

In *Everyday Mathematics* material is revisited repeatedly over months and across grades. This distributed practice helps students prepare for standardized mathematics assessments like PARCC and SBAC. The "spiral" design reinforces prior learning and keeps it fresh in students' memory, making it easier for them to recall. Research findings about the benefits of distributed learning are among the most robust in the learning sciences, applying across a wide range of content and for all ages from infants to adults (Pashler et al., 2007; Son and Simon, 2012). Distributed practice is embedded in EM4 in every regular lesson, but is most obvious in daily Math Boxes. It is another way that EM4 prepares students for standardized mathematics assessments. (For more information about the EM4 spiral design, see the white paper: *Everyday Mathematics and the Spiral*.)

Due to the strict alignment between EM4, the CCSS-M, and the PARCC and SBAC assessment frameworks, along with the *Everyday Mathematics* spiral design, daily use of EM4 in classrooms will provide students with an opportunity to learn the mathematics needed excel on the high-stakes mathematics assessments they take each year.

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