

Title: Summary of resources on the content demands of the CCSS/NGSS for math/science teachers in K–8

Date: October 2013

Question: Could you provide research/articles that describe the gap between the math/science content demands of the Common Core State Standards/Next Generation Science Standards and the math/science content knowledge of elementary teachers?

Response:

This memo includes:

1. **Books, reports, and articles:** Books, reports, and articles about the math/science demands of the Common Core State Standards and the Next Generation Science Standards. The publications included are primarily descriptive, as REL West was unable to find any rigorous, experimental studies on this topic.
 - Citations include a link to a free online version.
 - Citations are accompanied by an abstract, excerpt, or summary written by the author or publisher of the article.
2. **Relevant organizations** that may provide additional resources on this topic.

We have not done an evaluation of these resources or organizations, but rather provide them for your information only.

Books, Reports, & Articles

Achieve3000. (n.d). *10 steps for migrating your curriculum to the Common Core*. Lakewood, NJ: Author. Retrieved on October 9, 2013, from <http://www.arteducators.org/research/10 Steps for Migrating Your Curriculum to the Common Core.pdf>

Excerpt: As we get closer to actual Common Core implementation, local school districts, administrators, and teachers are finding themselves challenged by the task of moving from well-established state standards to the new, more demanding standards, which will almost certainly require unanticipated change in the way teachers teach and students learn. Certainly, meeting the Common Core standards' more demanding requirements—particularly for reading and the integration of nonfiction, text-dependent questions, and evidence-based argument into the classroom experience—will require new educational strategies and materials. In particular, it will demand increased emphasis on differentiated instruction, because all students are required to meet the standards. Because the Common Core necessitates changes in instructional practice,

professional development was emphasized by many of those interviewed for this paper. “The number one thing on principals’ minds is professional development. They ask themselves, ‘How can I get my teachers to become stronger leaders,’” says Saki Dodelson, CEO of Achieve3000, a leading provider of differentiated online literacy instruction solutions. This paper identifies 10 critical steps on the migration path to successful CCSS implementation. It is based on a synthesis of interviews with experts and curriculum developers in those states leading the way toward Common Core compliance and achievement. These “lessons learned” by the earliest Common Core adopters can clarify the path for “fast followers.”

Almy, S. (2012). *Instructional supports: The missing piece in state education standards*. Washington, DC: The Education Trust. Retrieved on October 9, 2013, from http://www.edtrust.org/sites/edtrust.org/files/publications/files/Instructional_Supports.pdf

Excerpt: The transition from current state standards to the new college- and career-ready standards is not a subtle shift. To make this transition as smooth as possible for teachers—who represent the front line in the rollout of new standards—they must have adequate tools to get the job done. States with more capacity to develop consistent high-quality materials have a responsibility to districts and teachers to provide not just new standards, but the necessary resources to teach them well. In this paper, The Education Trust offers insights about the best ways states can support our nation’s educators in their efforts to help students meet high academic standards. We hope this report will inform the decisions of education policymakers as they aim to use the new standards to lift achievement and prepare all students for college and careers.

Bybee, R. (2013). *Translating the NGSS for classroom instruction*. Arlington, VA: National Science Teachers Association. Retrieved on October 9, 2013, from http://www.nsta.org/store/product_detail.aspx?id=10.2505/9781938946011

Book description: With the release of the *Next Generation Science Standards (NGSS)*, you need a resource to help you answer pressing questions about how the standards fit with your curriculum, instruction, and assessments. Rodger W. Bybee has written *Translating the NGSS for Classroom Instruction* to provide essential guidance for everyone from teachers to school administrators to district and state science coordinators. As practical as it is timely, this book includes an introduction to *NGSS*; examples of the standards translated to classroom instruction in elementary, middle, and high school; and assistance in adapting current units of instruction to align with the standards. Bybee notes that the success of the new standards depends greatly on teachers’ ability to give students opportunities to learn the science and engineering practices, crosscutting concepts, and disciplinary core ideas of the *NGSS*. Reading this book is an important first step toward addressing educators’ questions and concerns about how to provide those opportunities and implement the standards.

The Center for the Future of Teaching & Learning at WestEd. (2012). *Willing but not yet ready: A glimpse of California teachers’ preparedness for the Common Core State Standards*. Sacramento, CA: Author. Retrieved on October 9, 2013, from <http://www.cftl.org/centerviews/february12.pdf>

Excerpt: California is on the precipice of implementing the Common Core State Standards (CCSS), which were developed through an initiative of the National Governors Association and the Council of Chief State School Officers to reflect the knowledge and skills needed for success in college and careers. In California, one of 45 adopting states, the standards represent a significant shift in expectations for both teaching and learning, not just in English language arts (ELA) and mathematics, but also in literacy related to science and history/social science. The newly adopted standards call for a deep conceptual understanding of the content in ELA and mathematics and,

also, for the ability to apply this content to other disciplines. New assessments aligned to the standards are due to be implemented in 2014–15. It all sounds good. But are teachers ready to teach to the new standards? This was the primary concern driving a series of focus groups commissioned by WestEd’s Center for the Future of Teaching and Learning in October 2011. Six groups were convened by Belden Russonello Strategists, LLC, to explore the following questions with teachers in Sacramento, San Francisco, and San Diego:

- How familiar are teachers with the CCSS?
- What are their beliefs about their own expertise and ability to teach their subject matter under the CCSS?
- What changes in practice do they think will be necessary to satisfy the new standards?

Dorph, R., Shields, P., Tiffany-Morales, J., Hartry, A., & McCaffrey, T. (2011). *High hopes–few opportunities: The status of elementary science education in California*. Sacramento, CA: The Center for the Future of Teaching and Learning at WestEd. Retrieved on October 9, 2013, from http://www.cftl.org/documents/2011/StrengtheningScience_full.pdf

Excerpt: This report addresses how well California is doing to prepare its young people for the evolving economy and societal challenges. Specifically, it describes the status of science teaching and learning in California public elementary schools. This study was conducted in support of Strengthening Science Education in California, a research, policy and communications initiative that explores the strength of science teaching and learning and offers recommendations for improving science education in California. Partners in this initiative include the Center for the Future of Teaching and Learning at WestEd; the Lawrence Hall of Science at the University of California, Berkeley; SRI International; Belden Russonello & Stewart; Stone’s Throw Communications; and Inverness Research. The report synthesizes findings from multiple sources of data collected during 2010–11: surveys of district administrators, elementary school principals, and elementary school teachers; case studies of elementary schools; and data available through existing statewide datasets. It is one in a series of reports designed to provide timely and actionable information about the status of science education in California and to identify ways it can be strengthened. The central finding of this report points to the need for significant improvement: children rarely encounter high-quality science learning opportunities in California elementary schools because the conditions that would support them are rarely in place.

Fulp, S. (2002). *Status of elementary school science teaching: 2000 National Survey of Science and Mathematics Education*. Chapel Hill, NC: Horizon Research, Inc. Retrieved on October 10, 2013, from http://2000survey.horizon-research.com/reports/elem_science/elem_science.pdf

Excerpt: The 2000 National Survey of Science and Mathematics Education was designed to provide up-to-date information and to identify trends in the areas of teacher background and experience, curriculum and instruction, and the availability and use of instructional resources. A total of 5,728 science and mathematics teachers in schools across the United States participated in this survey, a response rate of 74 percent. Among the questions addressed by the survey:

- How well prepared are science and mathematics teachers in terms of both content and pedagogy?
- What are teachers trying to accomplish in their science and mathematics instruction, and what activities do they use to meet these objectives?

Kober, N., McIntosh, S., & Stark Renter, D. (2013). Year 3 of implementing the Common Core State Standards: Professional development for teachers and principals. *Washington, DC: Center on Education Policy*. Retrieved on October 9, 2013, from <http://www.cep-dc.org/displayDocument.cfm?DocumentID=422>

Abstract: This report, based on spring 2013 survey of state education agency officials in Common Core-adopting states, provides information on state efforts to prepare teachers and principals. The report examines which entities are providing Common Core-related professional development services within the states, the estimated proportion of teachers and principals that have participated in such services, and the challenges that states face in preparing educators to teach a Common Core-aligned curricula.

Kober, N., & Stark Rentner, D. (2012). Year 2 of implementing the Common Core State Standards: States' progress and challenges. *Washington, DC: Center on Education Policy*. Retrieved on October 9, 2013, from <http://www.cep-dc.org/displayDocument.cfm?DocumentID=391>

Abstract: This report, based on a fall 2011 survey of 35 Common Core State Standards-adopting states (including the District of Columbia), examines states' progress in transitioning the new standards. The vast majority of the states in the survey believe that the Common Core State Standards (CCSS) are more rigorous than previous state academic standards in math and English language arts. The vast majority of survey states are taking steps to familiarize state and district officials with the new standards and to align curriculum and assessments. However, most of the states in the survey do not expect to fully implement the standards until 2014–15 or later. In addition, a majority of the responding states caution that having adequate resources is a major challenge to full implementation of the CCSS.

Sadler, P., Coyle, H., Cook Smith, N., Miller, J., Mintzes, J., Tanner, K., & Murray, J. (2013). Assessing the life science knowledge of students and teachers represented by the K–8 National Science Standards. *CBE Life Sciences Education*, 12(3), 553–575. Retrieved on October 9, 2013, from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3763021/>

Abstract: We report on the development of an item test bank and associated instruments based on the National Research Council (NRC) K–8 life sciences content standards. Utilizing hundreds of studies in the science education research literature on student misconceptions, we constructed 476 unique multiple-choice items that measure the degree to which test takers hold either a misconception or an accepted scientific view. Tested nationally with 30,594 students, following their study of life science, and their 353 teachers, these items reveal a range of interesting results, particularly student difficulties in mastering the NRC standards. Teachers also answered test items and demonstrated a high level of subject matter knowledge reflecting the standards of the grade level at which they teach, but exhibiting few misconceptions of their own. In addition, teachers predicted the difficulty of each item for their students and which of the wrong answers would be the most popular. Teachers were found to generally overestimate their own students' performance and to have a high level of awareness of the particular misconceptions that their students hold on the K–4 standards, but a low level of awareness of misconceptions related to the 5–8 standards.

Trygstad, P. (2013). 2012 National survey of science and mathematics education: Status of elementary school science. Chapel Hill, NC: Horizon Research, Inc. Retrieved on October 9, 2013, from <http://www.horizon-research.com/2012nssme/wp-content/uploads/2013/09/2012-NSSME-The-Status-of-Elementary-Science.pdf>

Abstract: This report describes the status of elementary (grades K–5) science education based on the responses of 881 teachers, 438 of whom teach grades K–2 and 443 of whom teach grades 3–5. Details on the survey sample design, as well as data collection and analysis procedures, are included in the Report of the 2012 National Survey of Science and Mathematics Education. The

standard errors for the estimates presented in this report are included in parentheses in the tables, and narrative sections of the report generally point out only those differences that are substantial as well as statistically significant at the 0.05 level.

REL West note: See section on Content Preparedness on p. 4.

Relevant Organizations

The Common Core Educators Coalition (CCEC)

<http://www.achieve3000.com/resources/common-core-educators-coalition-ccec>

From the website: Recent studies reveal a growing gap between the texts that students read in school and those they'll be required to read in college and the workforce. In response, states are stepping up, raising their standards and lifting the expectation for all students with the new Common Core State Standards for language arts literacy. To help districts and schools adopt and succeed with these new standards, Achieve3000® has formed Common Core Educators Coalition together with leading educators nationwide. We invite you to join this vibrant, growing community and tap into a growing wealth of best practices for making Common Core the foundation for success. Become a member of the CCEC and you'll be given the opportunity to:

- Join webinars led by experts, such as Dr. Michael Kamil of Reading Next
- Receive regular updates on the Common Core State Standards
- Network with authorities on Common Core and College and Career Readiness, including our partners at MetaMetrics®, creators of the Lexile® Framework
- Connect with educators who face challenges similar to yours

The Center for the Future of Teaching and Learning at WestEd

<http://www.cftl.org/>

From the website: The Center for the Future of Teaching and Learning at WestEd is dedicated to strengthening teacher development policy and practice. Our website features recent information on teacher development including research, state and national policy and legislative initiatives, and models for effective practice. We invite policymakers, parents and teachers, researchers and journalists, and education and philanthropic organizations to use the resources of this site and join us in helping to ensure that every child learns from a fully prepared and effective teacher.

Education Commission of the States

<http://www.ecs.org/html/issue.asp?issueid=252> (Common Core State Standards page)

From the website: The Education Commission of the States (ECS) is an interstate compact created in 1965 to improve public education by facilitating the exchange of information, ideas, and experiences among state policymakers and education leaders. As a nonprofit, nonpartisan organization involving key leaders from all levels of the education system, ECS creates unique opportunities to build partnerships, share information, and promote the development of policy based on available research and strategies.

Next Generation Science Standards (NGSS) at National Science Teachers Association (NSTA)

<http://ngss.nsta.org>

From the website: NSTA is developing a portal that will enable dynamic browsing and searching of the NGSS, access to instructional resources aligned to the standards, tools for searching and sharing those resources, and much more. Watch this space for news and updates.

REL West note: see

http://learningcenter.nsta.org/products/symposia_seminars/Ngss/webseminar17.aspx for "Connections Between Practices in NGSS, Common Core Math, and Common Core ELA." This

web seminar took place on February 12, 2013. The presenter was Sarah Michaels from Clark University. In this seminar Dr. Michaels talked about connecting the scientific and engineering practices described in A Framework for K–12 Science Education with the Common Core State Standards in Mathematics and English Language Arts.

Promoting Rigorous Outcomes in Mathematics and Science Education

<http://promse.msu.edu/>

From the website: PROM/SE is a comprehensive research and development effort to improve mathematics and science teaching and learning in grades K–12, based on assessment of students and teachers, improvement of standards and frameworks, and capacity building with teachers and administrators.

Teaching Channel

<https://www.teachingchannel.org/?national=1>

From the website: Teaching Channel is a video showcase—on the Internet and TV—of inspiring and effective teaching practices in America’s schools. We have a rapidly growing community of registered members who trade ideas and share inspiration from each other. With the help of the Tch community, our mission is to revolutionize how teachers learn, connect, and inspire each other to improve the outcomes for all K–12 students across America. In order to accomplish this mission, we have three simple goals, all of them reliant on input from teachers:

- Build professional learning resources that teachers want
- Deepen and improve opportunities for teacher learning
- Elevate and celebrate teachers in our society

REL West note: See teaching videos on the topic of the Common Core at

https://www.teachingchannel.org/videos?page=1&categories=topics_common-core&load=1

Methods

Keywords and Search Strings Used in the Search

(mathematics OR math OR science) AND (“content demands” OR “content knowledge”) AND (“common core state standards” OR “common core” OR CCSS OR “next generation science standards”) AND (Elementary OR “k-5”)

Search of Databases

EBSCO Host, ERIC, SAGE Journals, Google, and Google Scholar

Also: U.S. Department of Education websites and the Attendance Works website.

Criteria for Inclusion

When REL West staff review resources, they consider—among other things—four factors:

- **Date of the Publication:** The most current information is included, except in the case of nationally known seminal resources.
- **Source and Funder of the Report/Study/Brief/Article:** Priority is given to IES, nationally funded, and certain other vetted sources known for strict attention to research protocols.
- **Methodology:** Sources include randomized controlled trial studies, surveys, self-assessments, literature reviews, and policy briefs. Priority for inclusion generally is given to randomized controlled trial study findings, but the reader should note at least the following factors when basing decisions on these resources: numbers of participants (Just a few? Thousands?); selection (Did the participants volunteer for the study or were they chosen?); representation (Were findings generalized from a homogeneous or a diverse pool of participants? Was the study sample representative of the population as a whole?).
- **Existing Knowledge Base:** Although we strive to include vetted resources, there are times when the research base is limited or nonexistent. In these cases, we have included the best resources we could find, which may include newspaper articles, interviews with content specialists, organization websites, and other sources.

This memorandum is one in a series of quick-turnaround responses to specific questions posed by educators and policymakers in the Western region (Arizona, California, Nevada, Utah), which is served by the Regional Educational Laboratory West (REL West) at WestEd. This memorandum was prepared by REL West under a contract with the U.S. Department of Education’s Institute of Education Sciences (IES), Contract ED-IES-12-C-0002, administered by WestEd. Its content does not necessarily reflect the views or policies of IES or the U.S. Department of Education nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. Government.