

Common Core and Creativity: A Webb's Depth of Knowledge Analysis

Dario Sforza, Ed.D.
High School Principal & Seton Hall University
dbsforza@gmail.com

&

Christopher H. Tienken, Ed.D.
Associate Professor
Seton Hall University
Department of Education Leadership, Management, and Policy
South Orange, NJ
@christienken
www.christienken.com
Christopher.tienken@shu.edu

&

Eunyoung Kim, Ph.D.
Associate Professor
Seton Hall University
Department of Education Leadership, Management, and Policy
South Orange, NJ
Eunyoung.kim@shu.edu

Paper presented at the annual conference of the National Council of Professors of Educational Administration, August 6, 2015, Washington, DC.

ABSTRACT

Our purpose for this study was to categorize the cognitive complexity and levels of creativity of the nationally adopted Common Core State Standards in Grades 9-12 English Language Arts and Math as compared to the cognitive complexity and levels of creativity of the former New Jersey Core Curriculum Content Standards in Grades 9-12 English Language Arts and Math using Webb's Depth of Knowledge framework. We aimed to reveal the extent to which 21st century skills, such as creativity, critical thinking, strategizing, and problem solving are "infused" into the Common Core State Standards as compared to 21st century skills infused into the previous New Jersey Core Curriculum Content Standards. This study provides an evidence-based evaluation of the decision of adopting the Common Core State Standards and their effectiveness in preparing students with the academically creative skills necessary to compete in our globally complex 21st century work environment. In addition to contributing to the scant research and literature on creativity in education, policy makers and curriculum writers can use my methodology, as shown in this study, to assess future educational standards and assessments.

Common Core and Creativity: A Webb's Depth of Knowledge Analysis

Essential skills, such as critical thinking and creativity, which are necessary in order for students to succeed in a knowledge-based 21st century economy, have gained a “growing appreciation” in business and education industries over the past 10 years. Schools across the country have been increasingly challenged to prepare students with 21st century competencies to compete in a global economy (Kyllonen, 2012, p. 3). While educational policy makers continue to focus on academic rigor and a standardized education system, business leaders require students, as the future workforce, to develop creativity, strategizing complexity, adaptability, and innovation as well as analytical and problem-solving skills (American Society for Training and

Development, 2009; IBM Study, 2010; Kyllonen, 2012; Adobe, 2012). *The Competitiveness and Innovative Capacity Report* states that “given the pace of change in today’s global economy, investments to promote innovation deserve more emphasis than at any time in the past” (U.S. Department of Commerce, 2012, pp. 2-3). Throughout this study, the terms cognitive complexity, creativity, innovation, analytical thinking, and problem-solving skills have been used synonymously with 21st century skills.

Documentation on the official CCSS website cites “higher-order thinking skills” (NGA Center & CCSSO, 2015, About the Standards) as a key component of the Standards, but what constitutes these skills for success in the global economy?

Calls for Higher-order Thinking

Commentators from think tanks and mainstream economic literature and education circles argue that higher-order thinking skills include creative thinking and strategic

thinking, and that these skills will help students become economically successful. The IBM Corporation (2012), the United States Council on Competitiveness (2012), the Institute for Management Development (2012), the Organisation for Economic Co-operation and Development [OECD] (2013), Pink (2006), Robinson (2011), and Zhao (2012), all identify variations of creative and/or strategic thinking as important skills that high school graduates need in order to access better options for college, careers, and life in general.

Cisco Systems Incorporated, Intel Corporation, Microsoft Corporation, and the University of Melbourne (2010) conducted *The Assessing and Teaching of 21st Century Skills* (ATC21S) study to identify and categorize skills that future employees will need in order to remain viable in the global economy. The ATC21S study divided skills into four categories, one of which is based exclusively on creative and strategic thinking:

- Ways of thinking: creativity, critical thinking, problem solving, decision making, and learning
- Ways of working: communication and collaboration
- Tools for working: information and communications technology (ICT) and information literacy
- Skills for living in the world: citizenship, life and career, and personal and social responsibility

Andreas Schleicher (Asia Society, 2010), OECD's head of the Programme for International Student Assessment (PISA) stated, "In the developing knowledge economy, workers are expected not to take orders, but to think in complex ways with ever-changing variables." Schleicher's emphasis on critical thinking was echoed in the United States by business and education lobbying groups. The American Society for Training and

Development (2010) identified “innovative thinking and action; the ability to think creatively and to generate new ideas and solutions to challenges at work” as crucial competencies and skills students will need to succeed in the global economy (p. 13). The National Education Association (NEA), the largest public educator special interest group in the U.S., warned its members that their students will not be able to meet the varied demands of a global economy and join the 21st century workforce unless schools prepare them with the skills to “create and innovate” (NEA, 2012, p. 24).

Although the type of creative and strategic thinking that public school personnel should develop in students can be debated, there seems to be general agreement in the mainstream business literature and education environment that creativity and strategic thinking have a role to play in P-12 education to prepare students for life beyond compulsory schooling.

New Jersey Context

As in other states, the New Jersey education landscape is not immune to the perceived pressure to equip students with higher-order thinking skills in order to prepare them for the global economy. New Jersey Department of Education (NJDOE) bureaucrats adopted the Common Core State Standards on June 16, 2010; just 14 days after the NGA and CCSSO (2010) officially released the final version of the standards.

Presumably, NJDOE bureaucrats agree that the CCSS will help students develop higher-order thinking and creativity. By replacing their former state standards in ELA and math with the CCSS, New Jersey education bureaucrats also imply that the CCSS are superior to the former NJ standards in those areas.

High School Focus

The CCSS claims of enhancing higher-order thinking and global competitiveness seem to resonate most concretely in high school. High school represents the end of compulsory schooling, and, according to the CCSS marketing materials, “The standards define the knowledge and skills students should gain throughout their K-12 education in order to graduate high school prepared to succeed in entry-level careers, introductory academic college courses, and workforce training programs” (NGA Center & CCSSO, 2015, About the Standards).

Given the rhetoric regarding the ability of CCSS to prepare students for all colleges and careers in a competitive global knowledge economy, one might expect to see creativity and strategic thinking embedded throughout the CCSS high school standards for English language arts (ELA) and mathematics (M) more so than previous versions of New Jersey curriculum standards in those subjects.

Problem, Purpose, and Questions

Over 40 states have adopted the CCSS (NGA Center and CCSSO, 2015), presumably because education bureaucrats in those states decided, perhaps influenced by the CCSS marketing rhetoric, that the CCSS would better prepare students by helping them develop higher-order thinking and creativity. However, little qualitative analytical research has been done to test this assumption or to demonstrate that the CCSS are superior to previous state standards in the development of higher-order thinking and creativity. Our purpose for this qualitative content analysis study was to describe and compare the percentages of the CCSS and former New Jersey Core Curriculum Content Standards (NJCCCS) in ELA and M that require students to demonstrate strategic and/or creative thinking at the high school level.

Three questions guided our study:

1. To what extent are creative and strategic thinking, as defined by Webb's Depth of Knowledge, embedded in the Common Core State Standards for English Language Arts and Mathematics for grades 9-12?
2. To what extent are creative and strategic thinking, as defined by Webb's Depth of Knowledge, embedded in the New Jersey Core Curriculum Content Standards for English Language Arts and Mathematics for grades 9-12?
3. What differences and similarities exist in creative and strategic thinking between the Common Core State Standards and New Jersey Core Curriculum Content Standards in English Language Arts and Mathematics for grades 9-12?

Conceptual Framework

Multiple conceptions and views attempt to define what constitutes higher order thinking in the public high school curriculum. The mainstream corporate literature tends to group creativity, innovation, entrepreneurship, and strategic or critical thinking together. However, scholarly frameworks allow researchers to deconstruct and categorize curriculum standards according to expected levels of cognition or thinking. Webb's (1997; 2007) Depth of Knowledge (DOK) is one such framework.

According to Webb (1997), Depth of Knowledge encompasses multiple dimensions of thinking, including the "level of cognitive complexity of information students should be expected to know, how well they should be able to transfer the knowledge to different contexts, how well they should be able to form generalizations, and how much prerequisite knowledge they must have in order to grasp ideas" (Webb, 1997, p. 15). We used Webb's

(1997; 2007) four DOK levels as lenses through which to deconstruct and describe the cognitive complexity of the CCSS and NJCCCS in grades 9-12 for ELA and M for this study:

- Level 1 (recall)
- Level 2 (skill/concept)
- Level 3 (strategic thinking)
- Level 4 (extended thinking)
 - Depth of Knowledge includes multiple forms of knowledge such as declarative, which is based on facts, and procedural, which can be described as practical “know-how” (Runco & Chand, 1995, p. 245). Declarative knowledge is linked to procedural knowledge; together they form the foundation that structures creative and strategic thinking opportunities. Levels 1 and 2 of Webb’s Depth of Knowledge focus on declarative and procedural knowledge (in other words, recall and basic application). Webb’s Levels 3 and 4 include creative and strategic thinking and provide opportunities for students to experience deeper, analytical, and more divergent types of thinking. Researchers argue that creativity and strategic thinking occur at Levels 3 and 4. We equated DOK Levels 3 and 4 with the types of thinking that commentators in the mainstream business and education literature refer to when they call for students to develop higher-order thinking skills. If a set of curriculum standards does not have an appropriate flexible mix of cognitive complexity, including various DOK levels of thinking, students will not be able to gain the consistent learning experiences they need in order to think effectively at Webb’s DOK 3 and 4 levels of cognition. If cognitive flexibility is not embedded in the standards and they are over-weighted with Level 1

and 2 standards, students will reach what Runco and Chand (1995) call “functional fixedness” (as cited in Ward, Smith, & Finke, 2010, p. 201, p. 247).

A curriculum standard with functional fixedness would be categorized as a Level 1 recall or, at most, a Level 2 basic application in terms of Webb’s DOK. Standards at levels 1 and 2 do not have the divergent thinking opportunities needed to develop cognitive flexibility and therefore could impede students from formulating cognitively complex creative and strategic ideas.

If the “know-how” of curriculum standards and the dangers of functional fixedness are understood during the creation of curriculum standards, these standards can potentially increase “originality and flexibility,” two of the critical ingredients of creative and strategic thinking, by ensuring that a mix of cognitive levels appears throughout the standards in each subject and for each grade level (Runco & Chand, 1995, p. 245). If deeper levels of cognitive demand are absent and content is repetitive in nature, standards can jeopardize complex efforts to help students become creative and original thinkers (Runco & Chand, 1995, p. 245).

Methodology

We used a qualitative case study design with content analysis methods to describe and compare the percentages of the CCSS and of the former New Jersey Core Curriculum Content Standards (NJCCCS) in ELA and M that require students to demonstrate strategic and/or creative thinking. The content analyzed in this study consisted of CCSS and NJCCCS documents presenting the curriculum content standards for grades 9-12 mathematics and English language arts.

Deductive category application was used to connect Webb's existing Depth of Knowledge framework to the high school CCSS and NJCCSS in ELA and M (Mayring, 2000).

Coding

Webb's Alignment Tool (WAT) training manual contains important definitions, explanations, and examples for coders to reference and specifically understand what the DOK levels should look like for English Language Arts and Mathematics objectives. We used two trained coders to analyze and code each set of standards. Webb's definitions of each DOK level helped ensure the coders' reliability and consistency as they rated each standard (Webb, et al., 2005, p. 36).

The descriptions, examples, and coding rules helped to increase the probability that coders understood precisely which DOK level should be assigned to each standard. Mayring's step model was adapted and revised for this study to include descriptions of Webb's depth of knowledge (DOK) levels excerpted from the Web Alignment Tool (WAT) training manual (Webb, 2005, p. 45-46, 70-75).

Reliability

According to Merriam (2009), documentary data are persuasive, allowing little room for the researcher to "alter what is being studied" (p. 155). In order to increase the reliability of the findings between coders and the overall credibility of the results, the findings of this study were compared to previous studies, for which researchers coded the Common Core State Standards using the WAT for alignment purposes, which had already undergone peer review.

Another step we took to increase the coders' reliability was a "double-rater read behind consensus model," which proved effective in coding standards for other studies

(Miles, Huberman, & Saldaña, 2014, p. 84; Sato, Lagunoff, & Worth, 2011, p. 11). Both analysts in this study used the same data, coding agenda, and rules of coding. Content clustering or grouping of standards, similar to those used in Sato et al.'s (2011) study, was used in coding the standards for this study.. The content clustering allowed us to make more reliable decisions about the DOK of overlapping standards.

Niebling (2012) provided an important warning that we heeded in preparing our coding standards: "Perhaps the most complicated work involved in using the Webb alignment model is helping coders of standards, objectives, and test items understand and reliably code them according to the DOK framework" (p. 12). The read-behind method allowed for ongoing consensus during the coding process.

The double-rater read behind consensus model continued with the grades 9-12 CCSS in ELA and Math. Following the completion of all coding for the NJCCCS and CCSS, the coders compared their CCSS findings with Florida State University's CPALMS (2012) study, which rated all CCSS based on DOK. This triangulation strategy of using the double read behind method and comparing the coders' results with those from previous studies increased the validity of our findings.

If consensus could not be reached on a standard, we followed Webb's et al. (2005) recommendation and used the higher of the two DOK levels.

Findings

Overall, the high school Common Core State Standards in ELA and M contained fewer standards rated at DOK Levels 3 and 4 than the 2009 New Jersey high school standards in ELA and M. That is, the standards that NJ had in place prior to adopting the Common Core provided more of the Level 3 and 4 higher-order skills cited in mainstream

business and education publication as necessary capabilities for competing in a global economy. The following sections provide a detailed account of the results for each subject area as they relate to each research question. The major findings identified as the 9-12 Grade ELA and Math CCSS were compared to the NJCCCS, using the DOK framework, as follows:

1. When using DOK as an analytic framework, the findings indicate that overall both the Grades 9-12 ELA and Math NJCCCS (2008) were rated at a higher level of cognitive complexity as compared to the Grades 9-12 ELA and Math CCSS (2010).
2. The Grades 9-12 ELA NJCCCS were rated at an overall higher percentage of DOK Levels 3 and 4 than were the Grades 9-12 ELA CCSS.
3. The Grades 9-12 Math NJCCCS were rated at an overall higher percentage of DOK Levels 3 and 4 than were the Grades 9-12 Math CCSS.
4. The Grades 9-12 ELA and Math CCSS had a higher percentage of lower rated standards, DOK Levels 1 and 2, as compared to the Grades 9-12 ELA and Math NJCCCS.

Comparisons

Our third research question asked: What differences and similarities exist in creative and strategic thinking between the Common Core State Standards and the New Jersey Core Curriculum Content Standards in English Language Arts and Mathematics for grades 9-12?

We found a 10% difference in high school ELA standards categorized as Level 3 or 4 favoring the former NJ standards compared to the CCSS. There was a 26% difference favoring the NJ math standards compared to the CCSS (See Table 1).

Table 1

DOK Comparisons for High School CCSS and NJ ELA and M Standards

	Levels 1 & 2	Levels 3 & 4
CCSS ELA	72%	28%
NJ ELA	62%	38%
CCSS M	90%	10%
NJ M	64%	36%

These results suggest that the previous versions of the NJ high school ELA and M standards included more higher-order thinking and provided more opportunities to practice the types of thinking valued in the mainstream literature as necessary to compete in the global economy. The CCSS are not superior to the previous version of the NJ high school standards in ELA and M if the goal of the CCSS is to provide more higher-order thinking.

Recommendations for School Administrator Practice

Regardless of whether they support or reject the CCSS, high school administrators in New Jersey should work with their professional staff to review their school's curriculum to and augment it to include opportunities for creative and strategic thinking beyond those required by the CCSS in ELA and M. High school administrators, in collaboration with their professional staff, might endeavor to revise and customize existing objectives and activities in their state mandated ELA and M curricula to generate more creative and strategic thinking opportunities for students. The results of our study suggest a preponderance of procedural and declarative knowledge and thinking in the ELA and M CCSS. The danger

here is that the CCSS ELA and M standards in high school might instill functional fixedness in student thinking and hinder their ability to enter the post-secondary global economic environment (Runco & Chand, 1995).

One way to inject creativity and strategic thinking into curricula is to add activities that focus on socially conscious problem solving. Problem-based activities derived from issues found in American society, as well as international issues, have a track record of providing students opportunities to engage in creative and strategic thinking, while also producing superior results on traditional measures of academic achievement (e.g., Aikin, 1942; Boyer, 1987; Dewey, 1938; Isaac, 1992).

Another way to inject more higher-order thinking in the CCSS would be put the previous NJ ELA and M standards categorized as Level 3 or 4 back into their school curricula. High school administrators in NJ could add at least 10% more higher-order thinking in ELA and 20% in M just by reusing a curricular “wheel” that already exists instead of trying to reinvent one.

High school administrators in other states might also take notice of our results. They might choose to engage in a review of their previous state standards in ELA and M to determine if they contained more higher-order thinking compared to the CCSS. As we learned from the results of this study in New Jersey, high school administrators should not rely on the claims of others regarding the ability of the CCSS to provide superior levels of higher-order thinking. We suggest they adopt the mantra, “show us the data” when it comes to this claim.

References

- Aikin, W. M. (1942). *The story of the eight-year study with conclusions and recommendations*. New York, NY: Harper & Brothers.
- American Society for Training and Development (ASTD). (2009). *Bridging the skills gap*. Retrieved from <http://www.astd.org/%20About/~ /media/Files/About%20ASTD/Public%20Policy/%20BridgingtheSkillsGap2010.pdf>
- Asia Society. (2010, Dec. 7). *PISA chief explains the data*. Author. Retrieved from <http://asiasociety.org/education/learning-world/pisa-chief-explains-data>
- Boyer, E.L. (1987). *College: The Undergraduate Experience in America*. New York: Harper & Row.
- Cisco Systems Inc., Intel Corporation, Microsoft Corporation, & University of Melbourne. (2010). *Assessment and teaching of 21st century skills (ATC21S)*. Retrieved from <http://www.cisco.com/web/strategy/docs/education/atc21s.pdf>
- Council of Chief State School Officers [CCSSO]. (2010). Press release: National Governors Association and state education chiefs launch common state academic standards. Retrieved from http://www.ccsso.org/News_and_Events/Press_Releases/NATIONAL_GOVERNORS_ASSOCIATION_AND_STATE_EDUCATION_CHIEFS_LAUNCH_COMMON_STATE_ACADEMIC_STANDARDS_.html#sthash.IwRxgnGo.dpuf
- Dewey, J. (1938). *Experience and education*. New York, NY: Macmillan.
- Florida State University. (2013). *CPALMS*. Retrieved from <http://www.cpalms.org/Downloads.aspx>

- Hsieh, H. F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research*, 15(9), 1277-1288.
- IBM Corporation. (2012). Global chief executive officer study. Author. Retrieved from <http://www-935.ibm.com/services/us/en/c-suite/ceostudy2012/>
- Isaac, K. (1992). *Civics for democracy. A journey for teachers and students*. Washington, DC: Essential Books.
- Maxwell, J. A. (2005). *Qualitative Research Design: An Interactive Approach* (2nd Ed. ed.). Thousand Oaks, CA: Sage.
- Mayring, P. (2000). Qualitative content analysis. *Forum: Qualitative Social Research*, 1(2). Retrieved from <http://www.qualitativeresearch.net/index.php/fqs/article/view/1089/2386>
- Merriam, S. B. (2009). *Qualitative research: A guide to design and implementation*. San Francisco, CA: Jossey-Bass.
- Miles, M. B., Huberman, A. M., & Saldaña, J. (2014). *Qualitative data analysis: A methods sourcebook*. Thousand Oaks, CA: Sage.
- National Education Association. (2012). *Preparing 21st century students for a global society: An educator's guide to "the four Cs."* Washington, DC: Author. Retrieved from <http://www.nea.org/assets/docs/A-Guide-to-Four-Cs.pdf>
- National Governors Association and Council of Chief State School Officers. (2015). About the standards. Washington, DC: NGA and CCSSO. Retrieved from: <http://www.corestandards.org/about-the-standards/>

- New Jersey Department of Education. (2012a). *Education transformation task force final report*. Author. Retrieved from <http://www.state.nj.us/education/reform/ETTFFinalReport.pdf>
- New Jersey Department of Education. (2012b). *New Jersey application for funding under Race To The Top phase 3*. Author. Retrieved from <http://www.state.nj.us/education/rttt3/about/Application.pdf>
- New Jersey Department of Education. (2010). *Common core state standards: Preparing students for college and careers*. Author. <http://www.state.nj.us/education/sca/>
- New Jersey Department of Education. (2009). New Jersey core curriculum content standards in mathematics. Author. Retrieved from <http://www.state.nj.us/education/aps/njscp/Phase1allAreas.pdf#page=10>
- New Jersey Department of Education. (2009). New Jersey core curriculum content standards in language arts literacy. Author Retrieved from <http://www.ntuaft.com/TISE/Standards%20based%20assessments/Alternate%20Proficiency%20Assessment/APA/LAL%20CCCS.pdf>
- Niebling, B. C. (2012). Using Webb's Alignment Model to Measure Intended-Enacted Curriculum Alignment: A Brief Treatment. *Midwest Instructional Leadership Council, (1)* 1-17.
- Organisation of Economic Co-operation and Development [OECD]. (2013). *PISA 2012 results. What students know and can do: Student performance in reading, mathematics and science* (Vol. I). PISA, OECD Publishing. Retrieved from <http://www.oecd.org/pisa/keyfindings/pisa-2012-results-volume-I.pdf>

- Pink, D. (2006). *A whole new mind. Why right brainers will rule the future*. New York: Riverhead Books.
- Robinson, K. (2011). *Out of our minds: Learning to be creative*. North Mankato, MN: Capstone Publishers.
- Runco, M. A., & Chand, I. (1995). Cognition and creativity. *Educational Psychology Review*, 7(3), 243-267.
- Sato, E., Lagunoff, R., & Worth, P. (2011). SMARTER Balanced Assessment Consortium Common Core State Standards analysis: Eligible content for the summative assessment. (Final Report). Retrieved from <http://www.smarterbalanced.org/wordpress/wp-content/uploads/2011/12/Smarter-Balanced-CCSS-Eligible-Content-Final-Report.pdf>
- Ward T. B., Smith, S. M., & Finke, R. A. Creative cognition. In R. J. Sternberg (Ed.), *Handbook of Creativity*. (p. 189-212). New York, NY: Cambridge University Press.
- Webb, N. L. (1997). *Criteria for alignment of expectations and assessments in mathematics and science education* (Research Monograph No. 6). Washington, DC: Council of Chief State School Officers.
- Webb, N. L. (2007). Issues related to judging the alignment of curriculum standards and assessments. *Applied Measurement in Education*, 20, 7–25.
- Webb, N.L., Alt, M., Ely, R., & Versperman, B. (2005). *Web alignment tool training manual*. Wisconsin Center for Education Research. Retrieved from <http://wat.wceruw.org/index.aspx>
- Yuan, K., & Le, V. N. (2014). Measuring deeper learning through cognitively demanding

test items. Santa Monica, CA: RAND Corporation.

Zhao, Y. (2012). *World class learners: Educating creative and entrepreneurial students*.

Thousand Oaks, CA: Corwin Press.