

Determining the Cognitive Complexity of the Iowa Core in Literacy and Mathematics

Implications and Applications for Curriculum Alignment: Executive Summary

Bradley C Niebling, Midwest Instructional Leadership Council



October 9th, 2012

Determining the Cognitive Complexity of the Iowa Core in Literacy and Mathematics: Implications and Applications for Curriculum Alignment

Executive Summary

Since 2005, Iowa has been on a multi-year journey to invigorate our education system. One of the foundational elements of this effort has been the Iowa Core (formerly the Iowa Model Core Curriculum and Iowa Core Curriculum). The work of the Iowa Core over this time can be divided into three phases: (1) initial adopting and implementation, (2) adoption of the Common Core State Standards in Literacy and Mathematics, and (3) Iowa Core expansion. A common thread throughout all three phases of Iowa Core development has been a desire to set challenging, rigorous learning expectations for Iowa’s students. Accomplishing this goal requires defining the concept of “rigorous.”

When it comes to curriculum alignment, the issue of rigor is typically approached from the perspective of cognitive complexity/demand. *Cognitive complexity/demand*, as it applies to the Iowa Core, is defined as “what students are expected to do with topical/conceptual knowledge,” where *topical/conceptual knowledge* refers to “topics and information that student are supposed to learn” (Niebling, Roach, & Rahn-Blakeslee, 2008). In other words, cognitive complexity/demand is the type of thinking students need to be engaged in with the subjects and ideas they are learning about in their coursework.

Purpose of This Study

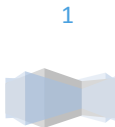
The purpose of this study was to obtain cognitive complexity/demand codes for the Iowa Core standards in Literacy and Mathematics that could be imported into the Iowa Curriculum Alignment Toolkit (I-CAT). The I-CAT is a free, web-based tool that allows teachers to enter reflections on what they taught relative to the Iowa Core standards. The I-CAT can be used as a teacher reflection and feedback tool, as well as part of local decision making about making curricular acquisitions and changes. Having cognitive complexity/demand codes in the I-CAT will allow teachers to reflect on, and get data-based feedback on, the extent to which what they teach aligns with the Iowa Core along the cognitive complexity/demand dimension. Webb’s Depth of Knowledge (DOK) framework was used to assign cognitive complexity/demand codes to the Iowa Core standards. Webb’s DOK goes from lower- to higher-order thinking skills in this manner: DOK 1 = Recall, DOK 2 = Skills and Concepts, DOK 3 = Strategic Thinking, and DOK 4 = Extended Thinking.

Study Questions and Results

A set of four questions was developed to serve as the focus for this study:

Question 1: *What is the distribution of cognitive complexity of the Common Core State Standards for English/Language Arts and Mathematics for grades K-2?*

The number and percentage of English/Language Arts standards at DOK Level 1 decreased as grade level increased, while the number and percentage of standards at DOK Levels 2 and 3 increased as grade level increased. For Mathematics grades K-2, the decrease in DOK Level 1 standards and increase



in DOK Level 2 across grades K-2 was less dramatic than in Literacy. There appears to be an increase in both the number and percentage of standards at DOK Level 3 for Grade 1, but lower for both Kindergarten and Grade 2. Though the results for Mathematics are harder to interpret than those for English/Language Arts, there does seem to be a general trend in both content areas of increasing cognitive rigor as students get older.

Question 2: *What is the distribution of the cognitive complexity for the Iowa-specific additions to the Iowa Core for Literacy and Mathematics?*

There were 48 Iowa-specific standards added to English/Language Arts across all grade levels/spans, and 10 for Mathematics. Most of the Iowa-specific additions to the English/Language Arts standards were at DOK Levels 2 and 3, with fewer at DOK Level 1 and none at DOK Level 4. Most of the Iowa-specific additions to the Mathematics standards were at DOK Levels 2 and 3, with fewer at DOK Level 1 and none at DOK Level 4.

Question 3: *What is the overall distribution of cognitive complexity for the Iowa Core for Literacy and Mathematics in grades K-12?*

In general, there appears to be an increase in cognitive complexity/demand across grades K-12 for both Literacy and Mathematics, though the pattern is much harder to detect in Mathematics after grade 2. Furthermore, there does appear to be a leveling off in terms of increase of cognitive complexity/demand in Literacy after grade 6. Finally, whereas there is a general increase in the number and percentage of DOK Level 4 standards starting in grade 3 in Literacy, there is only one DOK Level 4 standard in the entire set of Mathematics standards, in High School: Geometry.

Question 4: *What are the specific cognitive complexity codes for each standard in the Iowa Core for Literacy and Mathematics in grades K-12?*

Each standard has been assigned corresponding DOK codes. The resulting data tables have the data necessary to import into the I-CAT to add cognitive complexity/demand tools to that database.

Recommendations

Once the cognitive complexity/demand data are loaded into the I-CAT, work can be done to design new data input screens and reports to teachers can use the I-CAT to reflect on the cognitive complexity/demand of their instruction. The following are recommendations for considerations for curriculum alignment in general, and the I-CAT in particular:

1. **Training on Cognitive Complexity/Demand.** Successful use of the cognitive complexity/demand features of the I-CAT will rely on extensive training for teachers, administrators, AEA, and Department of Education staff to develop deeper understand of cognitive complexity/demand in general, and Webb's DOK in particular. A single, half-day training on how to use the cognitive complexity/demand features in the I-CAT is likely insufficient to develop this needed understanding.

2. [Integrate SBAC Cognitive Complexity/Demand Data into the I-CAT](#). Since Iowa is a member of the Smarter Balance Assessment Consortium (SBAC) and has access to the cognitive complexity/demand information that will be used to develop the SBAC assessments, it would be helpful to integrate information about SBAC into the I-CAT to allow teachers access to data describing the degree of alignment between their enacted curriculum and the assessed curriculum of SBAC assessments.
3. [Online Repository of Aligned Resources](#). Having DOK data in the I-CAT also provides possibilities to expand its functionality to include alignment examining and archiving of things like textbooks and related materials, online courses, and other instructional and assessment resources.
4. [Add Emphasis Features to the I-CAT](#). The next set of features to add to the I-CAT includes comparing the degree of emphasis among the Iowa Core standards, what teachers teach, and different types of assessments. For example, the I-CAT could be used to examine whether teachers spend a lot of time on content that is tested often or not.
5. [Determine Reliability of Validity of I-CAT Data](#). Users of the I-CAT need assurance that the tool can yield reliable and valid results. Determining reliability could be done by comparing I-CAT results to observation data or more frequently-collected teacher reflection data (e.g., daily logs). Determining validity could be done by comparing I-CAT data to another alignment tool (e.g., Surveys of Enacted Curriculum), or examining the relationship between I-CAT data and student outcome data (e.g., Iowa Tests or SBAC assessments).
6. [Determine Appropriateness of Cognitive Complexity/Demand Progression](#). Alignment with something like ACT's College and Career Readiness standards and assessment system on cognitive complexity dimension could provide a point of reference for determining the appropriate distribution of cognitive complexity/demand for the Iowa Core standards for grades 9-12. To help determine appropriate distribution of complexity back through earlier grade levels in the Iowa Core standards, having results from a predictive assessment system tightly aligned to the standards on the cognitive complexity/demand dimension could be helpful (e.g., curriculum-based measures).

Final Thoughts

It is important to note that comparative statements cannot be made about whether or not the Iowa Core in Literacy and Mathematics is more or less rigorous than some other set of standards using the results of this study. There are no baseline data to make this type of comparison. Regardless of what paths are pursued in the spirit of developing better distributions of cognitive complexity/ demand in the Iowa Core, cognitive complexity/demand is central to the success of the Iowa Core. Having the Iowa Core standards in Literacy and Mathematics coded according to Webb's DOK framework provides a foundation upon which to build the important work of teachers, their students, and those that support them.

