Iowa Department of Education

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

Implications and Applications for Curriculum Alignment

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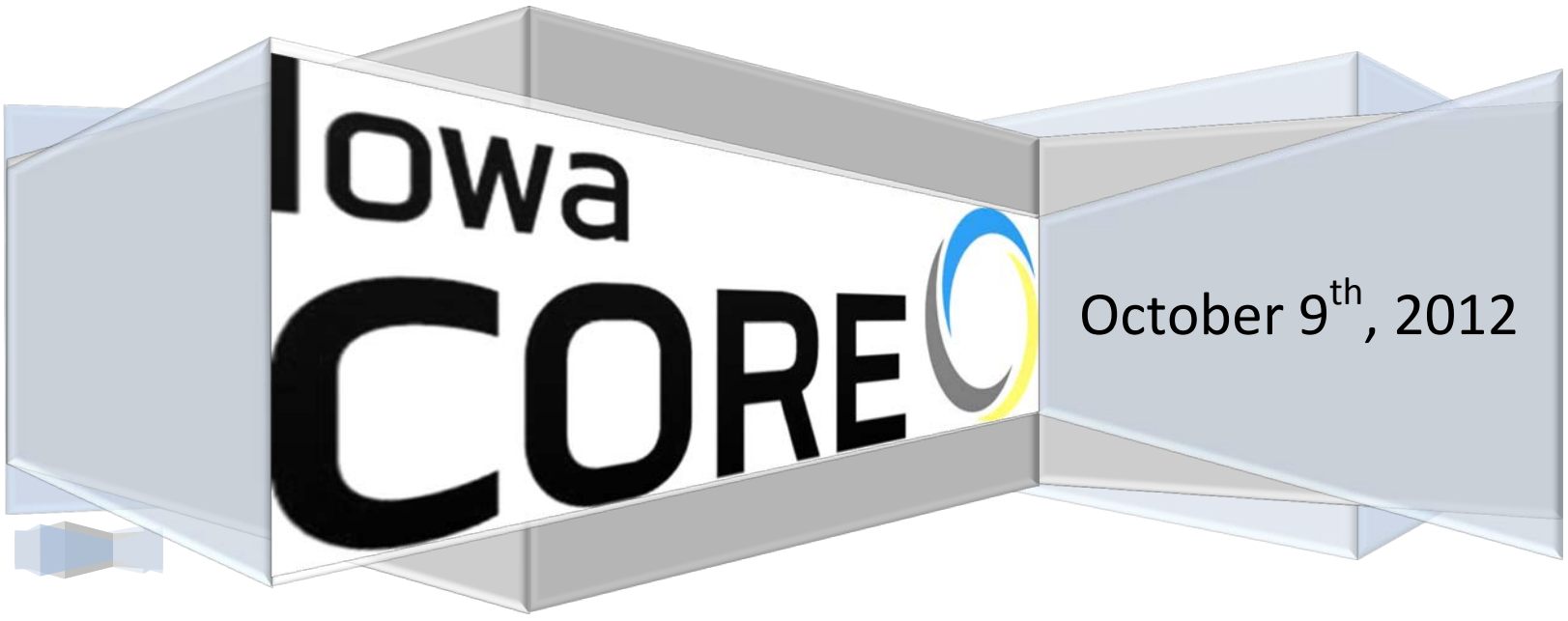

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Executive Summary

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."

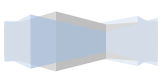
When it comes to curriculum alignment, the issue of rigor is typically approached from the perspective of cognitive complexity/demand. *Cognitive complexity/demand*, as it applies to the Iowa Core, is defined as "what students are expected to do with topical/conceptual knowledge," where *topical/conceptual 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.

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

Introduction

Since 2005, Iowa has been on a multi-year journey to reinvigorate 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 adoption and implementation, (2) adoption of the Common Core State Standards in Literacy and Mathematics, and (3) Iowa Core expansion. As the development of the Iowa Core has evolved over time, so too has the nature of work schools and districts should do with the Iowa Core. This report describes work related to the cognitive complexity called for by the Iowa Core Literacy and Mathematics standards. Furthermore, this report explores the implications and applications of the Iowa Core standards' cognitive complexity for the Iowa Department of Education's (i.e., the Department) efforts to promote and support quality curriculum alignment work as one means of facilitating Iowa Core implementation in Iowa classrooms.

Phases of Iowa Core Development

The intent of *Phase 1, initial adoption and implementation of the Iowa Core*, was two-fold. The first intent was to ensure that all Iowa students engage in a rigorous and relevant curriculum to prepare them for success in post-secondary education, the workforce and the emerging global economy. The second intent of the Iowa Core in *Phase 1* was to provide Iowa educators with the tools to assure that essential subject matter is being taught and essential knowledge and skills are being learned.

The work of *Phase 1* started after the Iowa Department of Education (i.e., the Department) and State Board of Education engaged in a series of high school visits during the spring of 2005. During the same time period, the Iowa Legislature passed Senate File 245 (S. File 245, 2005), which Governor Thomas J. Vilsack signed into law. The identification of a statewide high school model core curriculum in the areas of Literacy, Mathematics, and Science was one of several directives in this law (Iowa Department of Education, 2006).

In 2007, the Iowa Legislature passed Senate File 588 (S. File 588, 2007), expanding the Iowa Core (at that time known as the Iowa Core Curriculum) to include Social Studies and 21st Century Skills and to extend all five content areas from Kindergarten through 12th grade (Iowa Department of Education, 2008). Finally, in 2008, the Iowa Legislature passed Senate File 2216, making the Iowa Core mandatory for all public and accredited non-public schools (S. File 2216, 2008).

Phase 2 of the Iowa Core journey began in July, 2010 when the Iowa State Board of Education unanimously voted to adopt the K-12 Common Core State Standards (i.e., Common Core) in

English/Language Arts and Mathematics (Iowa Department of Education, 2010a). The policy side of this work was completed in November, 2010 when the Iowa State Board of Education voted on additions to the Common Core adoption proposed by the Department, adding 48 total standards K-12 in Literacy and 10 standards in Mathematics. Collectively, in Iowa, the document is still called the Iowa Core. This adoption was done as the next step in better defining a rigorous set of learning expectations for Iowa students, to make them more competitive in the global market (Iowa Department of Education, 2010a).

Phase 3 of the Iowa Core work began shortly after *Phase 2* was completed. It began when Department Director and "Head Learner" Jason Glass arrived in the fall of 2010. Working with Iowa Governor Terry Branstad, he lead the development of a blueprint for the future of education in Iowa, entitled *One Unshakable Vision: World-Class Schools for Iowa* (Iowa Department of Education, 2011). This blueprint was further defined in a set of legislative recommendations (H. Study Bill 517) set forth by Governor Branstad and Director Glass, which are summarized in the *Brief on Branstad-Reynolds Administration Recommendations for World-Class Schools* (Iowa Department of Education, 2012). A few points related to this vision and set of recommendations are worth mentioning at this point.

One of the foundations of the Governor's and Director's vision for education in Iowa is setting high expectations for all students. The Iowa Core is the centerpiece of defining those high expectations for students (Iowa Department of Education, 2012). Another foundational element of their vision is a system of assessments aligned to those expectations is needed so student learning can be monitored at different points in their K-12 education career. Iowa joined the national assessment consortium, SMARTER Balance, as a governing member in 2011. The purpose of SMARTER Balance is to develop assessments aligned with the Common Core to assess college and career readiness. SMARTER Balance helps fulfill the facets of the Governor's vision for education in the areas of assessing college and career readiness (Iowa Department of Education, 2012).

Curriculum Alignment: In Pursuit of Statewide Iowa Core Implementation

Translating the Iowa Core into action in classrooms with teachers and students, through each of its phases of development, has been the charge of the Department. The Department was charged with promoting and supporting practices that would not only provide all students across Iowa equity in their opportunity to learn what was defined in the Iowa Core, but also to ensure that over time teachers had access to assessment information about their students that also related to the Iowa Core. One of the methods selected by the Department to work towards these goals was in the area of curriculum alignment. To understand why the Department chose to pursue curriculum alignment, two lenses are required. The first is the definition of key concepts and terms used for the Department's curriculum alignment work. The second are the policy and research considerations taken by the Department in development, rolling out, and implementing curriculum alignment.

Definitions of Key Curriculum Alignment Concepts and Terms

During the 2008-09 school year, the latter part of Phase 1 of Iowa Core development, the Department began work to define what was legislatively mandated: what does "full implementation" of the Iowa Core entail for districts? An area of practice that emerged as central to Iowa Core implementation was curriculum alignment. The Department then defined key curriculum and alignment concepts and terms to serve as both a foundation and context for Iowa Core implementation.

The Framework

In the Iowa Core curriculum alignment framework, curriculum is broken down into four categories: (a) intended (i.e., what is supposed to be taught, in this case the Iowa Core), (b) enacted (i.e., what is actually taught and it is taught), (c) assessed (i.e., what is assessed), and (d) learned (i.e., what is learned by students, as demonstrated through the assessed curriculum) (Figure 1; Porter, 2006). By breaking curriculum down into different categories, we can examine the degree of alignment between a wide range of elements, such as the Iowa Core standards, instructional materials, lesson plans, tests, and what students actually learned during the school year (see Appendix A for more detailed definitions of these terms).

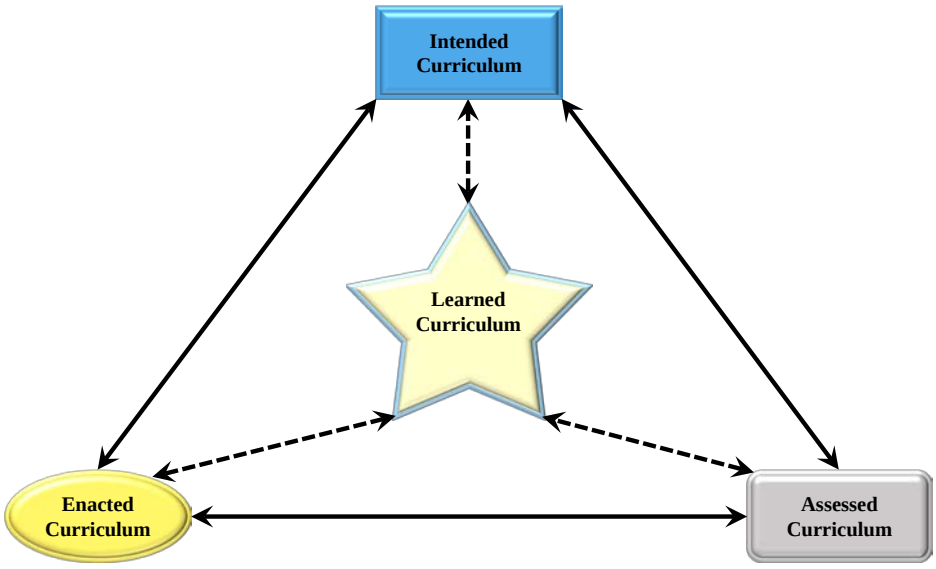


Figure 1. Learning-centered curriculum triangle.

Alignment, like curriculum, is not a singular thing. It too is a multi-faceted component of educational systems. *Alignment* is the extent to which and how well all curriculum elements (e.g., content, instruction, and assessment) work together to guide instruction and, ultimately, facilitate and enhance student learning (Webb, 1997). In the case of the Iowa Core, "policy elements" are the intended, enacted, assessed, and learned curricula. In general, alignment can be broken down into three categories: (1) directionality (i.e., horizontal and vertical), (2) dimensions (i.e., topical/conceptual knowledge, cognitive complexity/demand, and emphasis),

and (3) level of analysis (fine-grained/coarse-grained) (Figure 2; Niebling, Roach, & Rahn-Blakeslee, 2008). Alignment work always involves each of these three categories, though they may not formally be taken into consideration (see Appendix B for more detailed definitions of these terms).

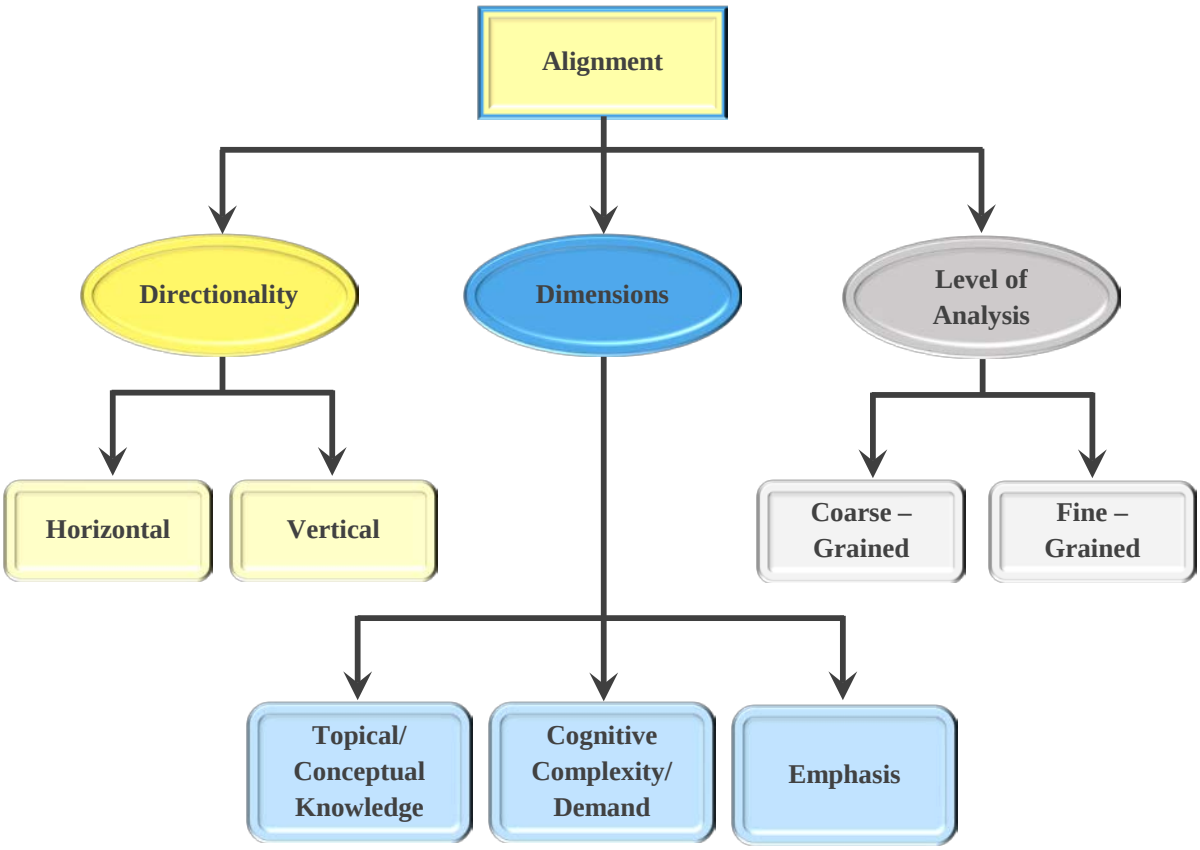


Figure 2. Multi-dimensional depiction of alignment.

Collectively, this framework of curriculum and alignment allows for a comprehensive examination of the similarities and differences among a wide range of curricular categories in educational systems. Some examples of potential alignment connections in the context of these frameworks include: (a) connections vertically through the system or across curricular categories at the same level in the system (i.e., directionality); (b) an exclusive focus on the topics and ideas of the curricula, or an inclusion of the type of thinking students are expected to engage in, or how much time or points earned are included (i.e., dimensions); and (c) taking a very broad or specific view during the types of examinations described in "a" and "b" (i.e., level of analysis).

Understanding Rigor in the Curriculum Alignment Framework

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," a challenging and elusive process, with few experts

agreeing on what it truly means. Rigor has been defined in tandem with the concept of relevance for the Iowa Core in this way:

"A rigorous and relevant curriculum is one that is cognitively demanding and challenging to students as they apply the essential concepts and skills to real world, complex and open-ended situations. The content is not just interesting to students, but involves particular intellectual challenges. When students successfully meet these challenges, their new learning will have meaning and value in contexts beyond the curriculum unit or classroom setting.

Rigor and relevance is characterized by content that is linked to a core disciplinary concept or skill and

- *Requires students to do authentic work, using methods that are specific to the discipline and applying what they know or what they are learning to solve complex problems*
- *Involves the use of prior knowledge, the development of in-depth understanding, and the ability to develop and express ideas and findings through elaborated communication*

A rigorous and relevant curriculum requires students to use knowledge to create and apply solutions to complex, real-world problems" (Iowa Department of Education, 2010b).

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 et al., 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. Although rigor may be broader than just cognitive complexity/demand, using cognitive complexity/demand as one method of measuring part of rigor is defensible, given how both have been defined for Iowa Core work.

It is important to note that some evidence exists indicating that the Common Core may not be as much progress in the area of implementing higher or more rigorous learning expectations for our students. For example, a study by Porter and colleagues indicates that the Common Core falls in the middle of the pack in terms of complexity (amongst other variables as well) when compared to existing state standards (Porter, McMaken, Hwang, & Yang, 2011a), with an overall slight increase in higher order thinking skills in the Common Core when compared to other sets of state standards in their study (Porter, McMaken, Hwang, & Yang, 2011b). This included a comparison of the standards from 27 states in Mathematics (as well as standards from the National Council of Teachers of Mathematics) and 24 states for English/Language Arts. They claim that perhaps reform advocates in the United States have been misguided in recommending that we uniformly pursue more rigorous standards. When compared to standards from countries like Finland, Japan, and Singapore, the Common Core actually calls for overall higher levels of cognitive complexity (Porter, McMaken, Hwang, & Yang, 2011a). Yet, students from these countries regularly outperform students from the United States.

It should be noted that the research done by Porter and colleagues (2011a) has drawn some criticism. In particular, concerns about how Porter and colleagues measure the focus of the standards and their omission of a coherence measure (Cobb & Jackson, 2011), as well as potential threats to the validity of their rating of standards using a cognitive complexity framework (Beach, 2011) have been expressed. While Porter and his colleagues agreed with several criticisms made by Beach, Cobb, and Jackson, they also noted that many of the points made by these authors were conceptual rather than empirical, and indicate a need for education to develop additional measures of focus, coherence, and rigor that yield reliable and valid results (Porter et al., 2011b). Findings and discussions such as these call on us to think critically about not only the practices we pursue, but how we discuss those practices as well.

Influence of Research

Despite numerous efforts to increase student achievement by writing content standards (e.g., National Commission on Excellence in Education, 1983) and developing high-stakes accountability assessments that are tightly aligned with those standards, we have yet to reach the goal of widespread increases in student achievement or closing achievement gaps between, for example, ethnicity groups. Indeed, there is compelling evidence that, even when content standards are considered to be of high quality, student achievement typically does not increase (Loveless, 2012). However, there is also compelling evidence that when curriculum alignment is considered, particularly between what is actually taught (i.e., enacted curriculum) and what is assessed (i.e., assessed curriculum), a positive impact on student achievement is observed.

For example, in a summary of several studies examining the degree of alignment between what was taught (i.e., enacted curriculum) and what was tested (i.e., assessed curriculum), Cohen (1987) found that the alignment between the enacted and assessed curriculum had a significant and large impact on student learning (i.e., learned curriculum). Large effect sizes, generally between 1.0 and 3.0, were reported by Cohen. The findings were significant in that groups of students in higher-alignment situations performed better than students in lower-alignment situations.

Adam Gamoran and his colleagues (1997) also found that, as opportunity to learn what was assessed increased, so too did student outcomes. In other words, students did better on assessments when they had a chance to learn what was on those assessments. Of particular importance in this study was the finding that factors typically associated with impacting student learning, such as prior achievement, socio-economic status, and ethnicity, were negated by the degree of alignment between the enacted and assessed curricula. However, this was only the case when cognitive complexity was included in the alignment calculations.

Collectively, when it comes to curriculum alignment, research and best practice provide us with several practices that are important to consider:

1. When engaging in curriculum alignment work, it is important to consider both topical/conceptual knowledge as well as cognitive complexity/demand.

2. There should be tight alignment between the content standards teachers are supposed to use (whether they be national or state standards) and the assessment tools that teachers are supposed to use (whether they be large-scale accountability assessments or locally-developed tools).
3. Teachers should tightly align the content and complexity of their instruction to the standards the standards used by the district in which they teach.

If each of these practices is followed, we should see an increase in student achievement, given what we know about the significant impact enacted-to-assessed alignment can have on student achievement (Perlman & Redding, 2011).

Influence of Policy

From a policy perspective, the state board's adoption of the Common Core in late 2010 has implications for several aspects of the Iowa Core implementation process for the Department, Area Education Agencies (i.e., "AEAs"), and local districts. One of the biggest implications to date of the Common Core adoption is on work related to Outcome 4: Alignment. Outcome 4 of the Iowa Core Implementation Plan framework requires districts to collect enacted-to-intended curriculum alignment data. Districts are to do so using two methods: (1) summative self-reporting, and (2) observation and dialogue. In this report, the focus is on the first requirement, summative self-reporting. It should be noted that as the Department works to integrate a wide range of required plans that districts need to complete and submit, the work of Iowa Core implementation will likely be rolled into that new system.

Heartland Area Education Agency 11 (i.e., Heartland), in collaboration with the Department and other AEAs in Iowa, has been developing a summative self-reporting tool known as the Iowa Curriculum Alignment Toolkit (i.e., I-CAT; Heartland Area Education Agency 11, 2011). The I-CAT is a web-based tool that teachers can log into and enter data on what they have taught over the course of a school year (i.e., enacted curriculum), and how that relates to what is found in the Essential Concepts/Skill Sets and Details and/or Standards of the Iowa Core (i.e., intended curriculum). 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. The Common Core, as well as the Iowa-specific additions to the Iowa Core, for grades K-12 was integrated into the I-CAT in the spring of 2011. With this integration into the I-CAT, educators in Iowa had a set of current processes and tools that could be used to fulfill the summative self-report requirement of Iowa Core Outcome 4.

However, the vision for curriculum alignment, the I-CAT, and the Iowa Core has extended beyond Outcome 4 requirements from the beginning (Niebling, 2011). Briefly, to move the alignment work forward beyond the minimum Outcome 4 requirements, the Department started on Phase 3 of the multi-pass roll out and engagement process during the 2011-12 school year (Figure 3). Specifically, the next step in the I-CAT work is to add the ability for teachers to reflect on their enacted curriculum through the lens of cognitive complexity/ demand. Given the call for "higher" standards and more "rigorous" coursework in Iowa (e.g.,

Iowa Association of School Boards, 2009; Iowa Department of Education, 2011), it is both important and timely to add these cognitive complexity/demand capabilities to the I-CAT, so teachers can examine the extent to which their enacted curriculum aligns with the cognitive expectations set forth in the Iowa Core.

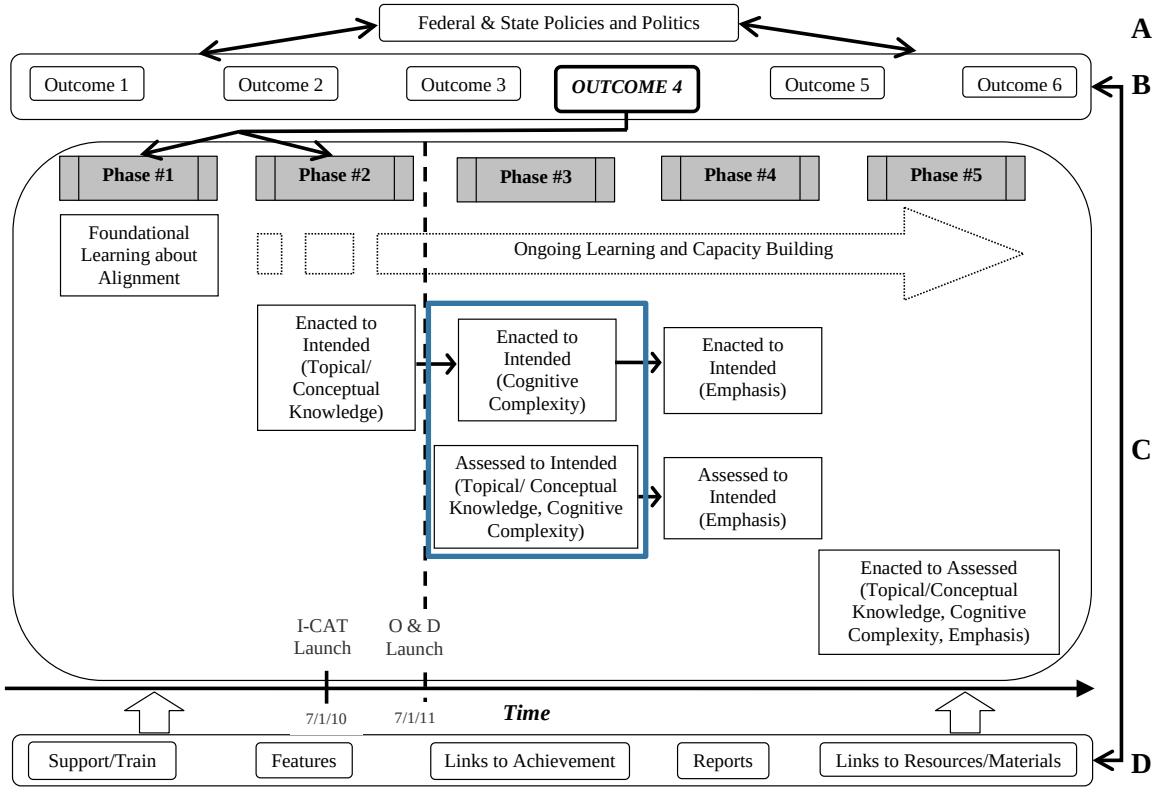


Figure 3. Multi-pass roll out and engagement process for alignment and the Iowa Core.

Cognitive Complexity of the Iowa Core

Evidence is already available regarding the cognitive complexity/demand (that is, to an extent, the rigor) of most of the Iowa Core. This evidence comes from two different studies. Results can be applied to our understanding of the Iowa Core because these studies focused on the Common Core, which constitutes the large majority of what the Iowa Core is in the areas of Literacy and Mathematics. First, Porter and his colleagues (2011a) used the content-specific cognitive demand frameworks from the Surveys of Enacted Curriculum (SEC) to, among other things, describe cognitive complexity/demand called for in the Common Core. In general, the SEC cognitive demand framework starts with lower complexity thinking skills and progresses to higher-order thinking skills. In this particular study, the results are shared for grades 3-6 combined as an illustration, given similarities when aggregated with a wider range of grade levels (Table 1).

Table 1. Cognitive Demand Distribution of the Common Core State Standards in English/ Language Arts and Mathematics for Grades 3-6 Combined (SEC Model)

English/Language Arts		Mathematics	
Cognitive Demand Category	**Percentage**	**Cognitive Demand Category**	**Percentage**
Memorize	8.07	Memorize	9.50
Perform Procedures	23.07	Perform Procedures	43.74
Generate	29.88	Demonstrate Understanding	35.65
Analyze	33.35	Conjecture	5.96
Evaluate	5.64	Solve Nonroutine Problems	5.16

A second study examining the cognitive complexity/demand of the Common Core (and thus in large part, the Iowa Core) was done by WestEd, commissioned by the SMARTER Balance Assessment Consortium (SBAC) to conduct a study of the Common Core to assist with future item development (Table 2; Sato, Lagunoff, & Worth, 2011). Included in this study was a coding of the Common Core for grades 3-12 according to Norman Webb's Depth of Knowledge (DOK) criteria, a widely-used framework for examining the cognitive complexity of content standards and assessments (Webb, 2005).

Table 2. Depth of Knowledge Distribution of the Common Core State Standards in English/ Language Arts and Mathematics for Grades 3-12 Combined (Webb's Model)

Depth of Knowledge Level	English/Language Arts	Mathematics
Level 1 = Recall	50%	89%
Level 2 = Skills and Concepts	76%	79%
Level 3 = Strategic Thinking	77%	21%
Level 4 = Extended Thinking	40%	<1%

In each of these studies, grade-specific cognitive complexity/demand was determined as well. Standard-specific cognitive complexity codes are also available from the WestEd study (Sato, Lagunoff, & Worth, 2011). Each of these studies provides a perspective on the distribution of cognitive complexity of the Iowa Core. However, two areas of cognitive complexity data are still missing: (a) grades K-2 of the Common Core State Standards, and (b) Iowa-specific additions to the Common Core for grades K-12.

Next Steps for the Iowa Curriculum Alignment Toolkit

Regardless of one's view as to the extent to which higher-order thinking skills should be pursued in Iowa's different curricula (i.e., intended, enacted, assessed), the Iowa Core defines the set of knowledge and skills students need to acquire and demonstrate, including the cognitive complexity/demand students are expected to engage in. As Gamoran and his colleagues (1997) found, it is important to know about cognitive complexity/demand when engaging in alignment work. Having standards-level cognitive complexity/demand data can also be useful for activities like instructional planning, instructional materials acquisition, and development of assessment processes and tools.

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 I-CAT. As it pertains to curriculum alignment, if teachers are going to be able to use the I-CAT to reflect on not only what they taught, but the rigor with which they taught it, cognitive complexity/demand information about the Iowa Core standards in Literacy and Mathematics needs to be added to the I-CAT. That requires the Iowa Core to be coded using a cognitive complexity framework, to integrate that coding into the I-CAT, and to build new features into the I-CAT to make use of the cognitive complexity codes. This study seeks to expand the WestEd study (Sato, Lagunoff, & Worth, 2011) and explore the following questions:

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?*

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

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

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

Method

Participants

Nine educators were selected by project leads from the Iowa Department of Education to assign cognitive complexity/demand codes to the Iowa Core in Literacy and Mathematics for grades K-2 and the Iowa-specific additions. One team of three coded both the Common Core and the Iowa-specific additions in the areas of Literacy, while two teams of three coded for Mathematics. The first team of three in Mathematics coded the Common Core for grades K-2, and the second team of three coded the Iowa-specific additions.

The median years of experience as an educator for the Literacy team was 24 years (range = 23-42 years), while the median years of experience for the Mathematics teams was 32 years (range = 23-48 years). All three members of the Literacy team were former classroom teachers; five of the six Math team members were former classroom teachers. Jobs held by members of the Literacy team at the time of the study were: (a) Building/District Administrator = 1, and (b) AEA or Department of Education Consultant = 2. Members of the Math team held the following types of jobs: (a) AEA or Department of Education Consultant = 4, (b) Private Practice Consultant = 2, and (c) University-Based Educator (one person was both a Private Practice Consultant and University-Based Educator).

The highest degrees held by Literacy team members were: (a) M.S./M.A. = 2, and (b) Ph.D./Ed.D. = 2. The highest degrees held by Math team members were: (a) B.S./B.A. = 1, (b) M.S./M.A. = 3, and (c) Ph.D./Ed.D. = 2. All coders were asked to rate themselves on a four-point scale (1 = Strongly Disagree, 4 = Strongly Agree) on the following statement: "I consider myself to be a content area expert in the area I coded for this study." The median response for both teams was a four, with a modal response of three for Literacy team members and four for Math team members.

Materials

Three sets of materials were used in this study: (1) Iowa Core standards in Literacy and Mathematics, (2) Cognitive Complexity Coding Project Manual, and (3) Cognitive Complexity Coding Project End of Project Survey.

Iowa Core Standards in Literacy and Mathematics

Two sets of documents that constitute the Iowa Core standards were coded for cognitive complexity in the current study: (a) the *Common Core State Standards in English/Language Arts and Mathematics* in grades K-2 and (b) the *Iowa-specific additional standards in Literacy and Mathematics* in grades K-12. The Common Core State Standards in English/Language Arts and Mathematics in grades 3-12 were coded for cognitive complexity by Sato, Lagunoff, and Worth (2011) and therefore were not coded in the current study. For this study, the term "English/Language Arts" is used to describe the Common Core documents. The term "Literacy" is used to describe the Iowa-specific additions as well as the combination of the Common Core and Iowa-specific additions (i.e., the Iowa Core).

Cognitive Complexity Coding Project Manual

Selection and Application of Cognitive Complexity Framework

Before developing training and coding procedures, a cognitive complexity framework needed to be selected for use in this study. Given widespread application and quality of *Webb's DOK framework*, Iowa's membership in SBAC, Iowa's desire to pursue high learning expectations for all students, the need to update the I-CAT to include cognitive complexity/demand features, and the existing coding of the Common Core using Webb's DOK framework, the team selected Webb's DOK for inclusion of cognitive complexity features in the I-CAT. Webb's DOK framework is a four-level, content-specific framework. The generic framework is as follows: 1= Recall, 2 = Skills and Concepts, 3 = Strategic Thinking, and 4 = Extended Thinking (Table 3). The content-specific information for English/Language Arts and Mathematics can be found in Appendix C of this report (pp. 10-17 of Coding Manual).

Table 3. Generic depth of knowledge levels in Webb's DOK framework.

Depth of Knowledge Level	Level Title
1	Recall
2	Skills and Concepts
3	Strategic Thinking
4	Extended Thinking

It should be noted that the WestEd study deviated from Webb's (2005) procedure of assigning a single DOK level to standards, instead assigning as many DOK levels to a standard as coders viewed appropriate (Sato, Lagunoff, & Worth, 2011). This was done largely "because some standards describe skills at multiple levels of complexity" (p. 11). According to Webb (personal communication, January 24th, 2012) assigning multiple DOKs to a single standard is acceptable if (a) the coding is done in the context of a descriptive study and not an alignment study; and (b) the standards are compound statements reflecting multiple ideas, each of which could be performed at a different DOK level. As such, the current study also allowed for multiple DOK assignments to standards if deemed appropriate by the coders.

Development of the Coding Manual

Once Webb's DOK framework was selected, the C*ognitive Complexity Coding Project (CCCP) Manual* was developed (Niebling, 2012). The CCCP Manual is based in large part on Norman Webb's Web Alignment Tool (WAT) Training Manual (2005), with some modifications and additions for the current study. The full CCCP Manual can be found in Appendix C. The manual includes: (a) background and contextual information that impacts the project, (b) implications for curriculum alignment of the background and contextual information, (c) flow of project activities, (d) coding guidelines and practice activities, and (e) operational definitions and descriptions of Webb's DOK framework for Reading, Writing, and Mathematics. Also included in the manual are links to all of the documents and data entry forms coders needed to successfully engage in the coding project.

Cognitive Complexity Coding Project End of Project Survey

The *CCCP End of Project Survey* is an online, 10-item self-report measure that was developed for this study (Appendix D). Coders used a four-point, Likert scale with 1 = Strongly Disagree and 4 = Strongly Agree to respond to each item. In general, the content of the items focused on different aspects of the training and support experienced during the project. All items were worded positively. For example, item three read as follows: "I had sufficient practice and support to successfully complete the project." Coders were also provided the opportunity to provide further narrative comments for each of the 10 forced-choice response items. The purpose of these items was to determine the extent to which participants felt they received the training and support they needed to implement the coding process with fidelity.

In addition to the 10 focus items of the survey, coders also entered demographic information related to the following characteristics: (a) the content area they coded for the study, (b) years

of professional education experience, (c) K-12 teaching experience, (d) current job/role in education, (e) highest degree earned, and (f) the extent to which they believed they were an expert in the content area they coded using the same four-point Likert scale.

Training and Calibration

After raters were identified, they were assembled into coding teams. The Literacy Team was assigned all Common Core State Standards for English/Language Arts for grades K-2, as well as the Iowa-specific additions in Literacy. Team 1 for Mathematics was assigned all Common Core State Standards for Mathematics for grades K-2, while Team 2 for Mathematics was assigned the Iowa-specific additions in Mathematics.

Training involved having teams review Webb's DOK framework, specifically reading the content-specific framework that applied to the content area they would be coding. The review included example standards that raters were to first mentally assign a single DOK, then compare their response to ratings found in Webb's training manual (2005). Each team completed this exercise by discussing the framework and how they assigned a DOK to each example standard.

Once raters completed their initial review of the DOK level descriptions and example ratings, they engaged in a calibration process. The purpose of the calibration process was twofold. The first goal was to ensure that members of each team developed a similar, common understanding of how to apply Webb's DOK framework to standards, so the thinking and application of the process was applied consistently across coders within a team. Second, to the extent possible, efforts were made to increase coding teams' similarity of application of Webb's DOK to the raters from the WestEd study (Sato, Lagunoff, & Worth, 2011). Since data from the WestEd study and the current study would be combined to assemble a complete picture of the cognitive complexity/demand of the Iowa Core, the goal was to establish a similar thinking approach to using Webb's DOK to assign codes to the standards to that employed in the WestEd study.

Given these two purposes for engaging in calibration, a two-stage process was employed to establish this calibration. In the first stage, teams followed the process they would ultimately use for coding the standards assigned to them. Within each team, raters independently assigned one or more DOK codes to a sample of five standards from the Common Core across grades 3-12 in their content area that had been previously coded by raters from the WestEd study. Once each team member completed his/her code assignments to a single standard, they engaged in a consensus discussion to resolve discrepancies and documented a final consensus for that standard. In the second stage, each team compared their consensus DOK code assignments for the first standard to the DOK code assignments from the WestEd study for that standard. Any existing discrepancies between team DOK code assignments and WestEd code assignments were discussed. This process was repeated for four additional standards.

All nine raters, as well as the content leads and session facilitator, discussed what a defensible rate of agreement with the raters from the WestEd study would be, so that they coders could be reasonably confident that they were applying Webb's DOK framework and the decision-making rules in a similar fashion. The team set the goal for agreement with the WestEd study coders to agree at least 75% of the time *before engaging in the calibration process*. Each team met this criterion without additional training or coding additional standards (Table 4). Detailed coding data for the calibration process can be found in Appendix E.

Table 4. Percent agreement between current study raters and WestEd raters

Team	Percent Agreement
Literacy	85%
Mathematics Team 1	90%
Mathematics Team 2	75%

Data Collection Procedures

Since the available DOK data was for grades 3-12 of the Common Core, DOK coding was necessary for grades K-2 of the Common Core, as well as the Iowa-specific additions to the Iowa Core. DOK data for grades 3-12 of the Common Core were collected in the WestEd study by using a "read-behind" consensus model with ongoing rater calibration. Briefly, this model calls for one rater to independently assign DOK codes to the standards, while the second rater reviews the codes of the first rater to determine if he/she agrees, noting agreement and disagreement. The raters discussed any discrepancies in an ongoing manner, working to achieve consensus on those discrepancies. At the end of the study, project leads reviewed the work of the two coders. For more information on this procedure, see Sato, Lagunoff, & Worth (2011).

In the current study, teams of three raters were assembled to review and code the Common Core State Standards for grades K-2 and the Iowa-specific additions to the Iowa Core. Each team member independently assigned DOK code(s) to each of the standards assigned to the team. Each team member was responsible for transferring their codes to a common, web-based spreadsheet. Once each team member had transferred their codes, teams engaged in consensus discussions to resolve any discrepancies that occurred between teammates. Each teams decided on their own how frequently to work on consensus (e.g., by grade level). Once consensus was reached, final DOK code(s) were assigned to each standard and documented in a consensus spreadsheet. The consensus spreadsheet for **Literacy** can be found at http://goo.gl/jccYZ and for **Mathematics** at http://goo.gl/x74F0.

The following guidelines were used by raters to help them assign codes to the standards (Niebling, 2012).

- The primary purpose of the coding process is to identify the level of cognitive complexity in the Common Core/Iowa Core for teachers to use in reflecting on or planning for instruction.

- You can assign more than one DOK per standard, and you have to assign at least one per standard. Consider which DOK(s) are clearly represented in the standards. If you are not sure if a DOK level is present or not in a standard, do not indicate it as present.
- The DOK level(s) of a standard should reflect the *complexity* of the standard, rather than its *difficulty*. The DOK level(s) describes the kind of thinking expected of students/involved in a task, not the likelihood that the task will be completed correctly.
- In assigning DOK level(s) to a standard, think about the complete domain of instruction/assessment items that would be appropriate for measuring the standard.

Data Analysis

The number and percentage of standards at each DOK level are calculated and graphed. Results for English/Language Arts and Mathematics are separately calculated, summarized, and reported. Visual analysis of graphed data is used to describe patterns and trends. Results are summarized in the following ways: (1) Common Core standards for kindergarten, first, and second grades; (2) Iowa-specific standard additions to the Common Core for each grade level (i.e., grades kindergarten through twelfth grade); (3) all Iowa Core standards for each grade level (i.e., combination of Common Core and Iowa-specific standards, grades kindergarten through twelfth grade); and (4) DOK code(s) assigned to each standard coded in the current study.

For Study Questions 1, 2, and 3, the following formula is used to calculate the percentage of standards at each DOK level:

$$\%\ of\ Standards = \frac{\#\ of\ Standards\ Coded\ at\ the\ DOK\ Level}{Total\ \#\ of\ Possible\ Standards}$$

For example, in English/Language Arts for first grade, there are 44 total standards, 23 of which are coded at a DOK level of "1." Using the formula, above, we get the following result:

$$\frac{23}{44} = 52\%\ at\ DOK\ Level\ 1$$

This basic formula was used to calculate all percentages reported for this study. It is important to note that, since the coders in the WestEd study assigned multiple DOK levels to some of the Common Core standards in grades 3-12, coders in the current study also assigned multiple DOK levels to standards as they deemed appropriate. As such, the percentages may not add up to 100% across the DOK levels for each grade level.

Results

Results for this study are organized around the four study questions. Quality of the data is addressed after the results are presented.

Study Questions

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 standards at each DOK level in English/Language Arts for the K-2 Common Core standards are found in Figures 4 and 5, respectively. The total number of possible standards at each grade level was 41, 41, and 40, respectively. Overall, it appears that the number and percentage of standards at DOK Level 1 decreased as grade level increased, whereas the number and percentage of standards at DOK Levels 2 and 3 increased as grade level increased.

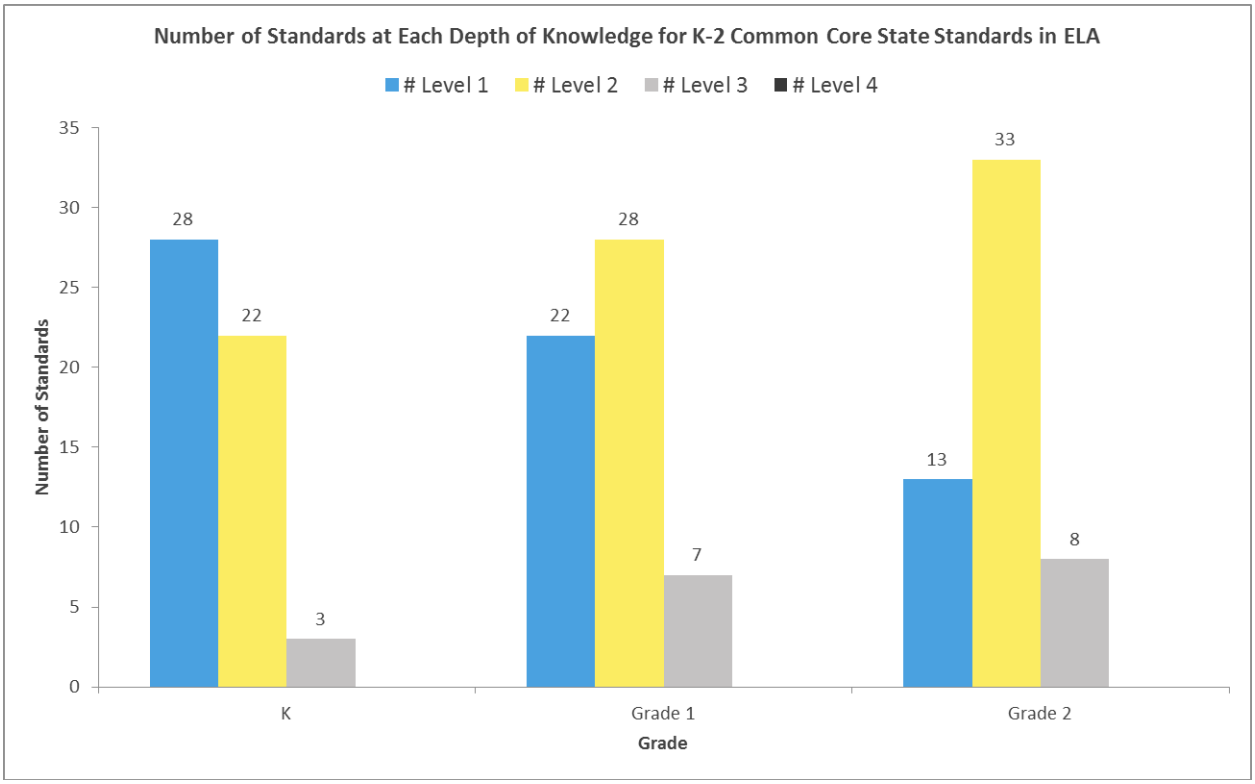


Figure 4. Number of standards at each Depth of Knowledge for Kindergarten through Grade 2 Common Core standards in English/Language Arts

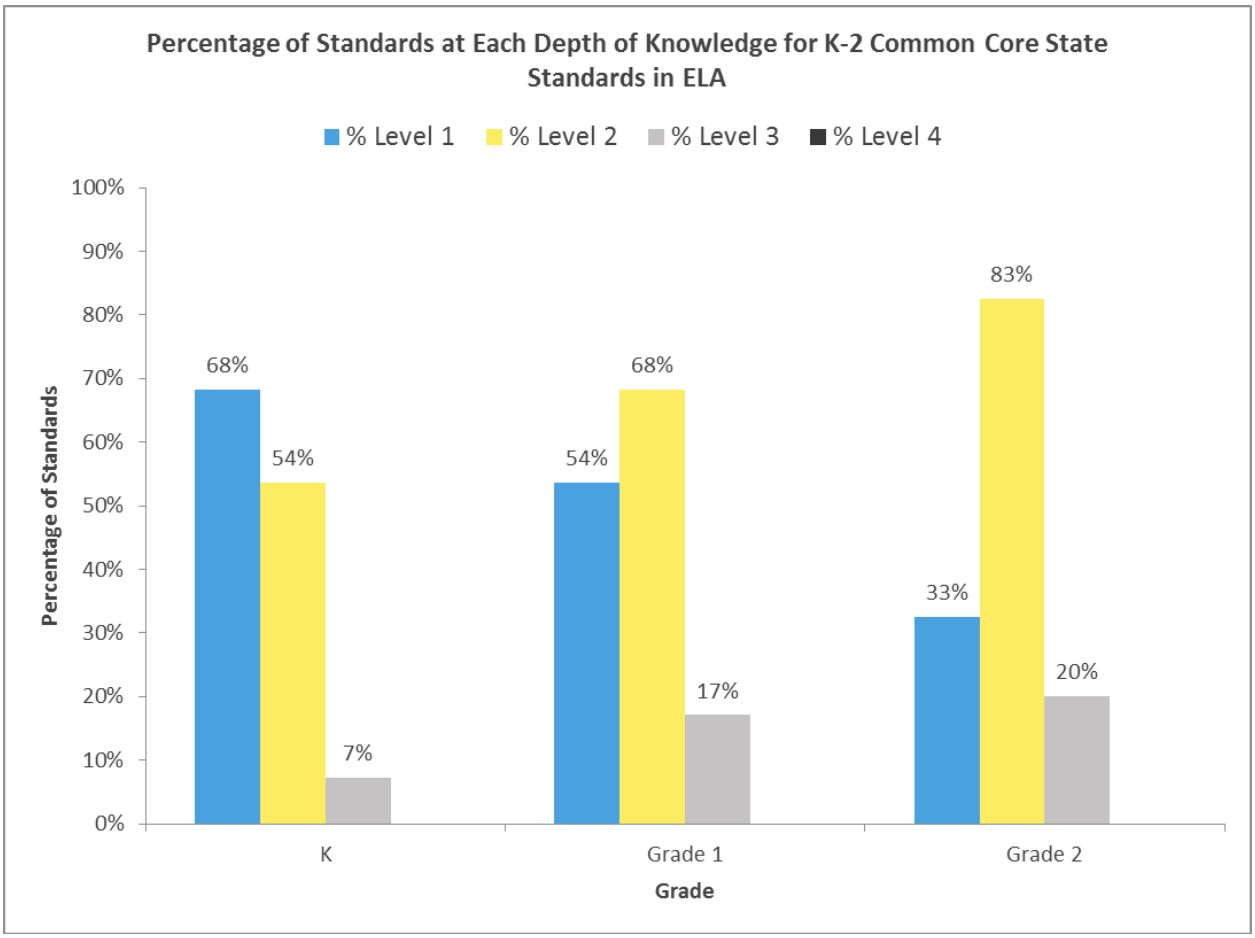


Figure 5. Percentage of standards at each Depth of Knowledge for Kindergarten through Grade Common Core standards in English/Language Arts

The number and percentage of standards at each DOK level in Mathematics for the K-2 Common Core standards are found in Figures 6 and 7, respectively. The total number of possible standards at each grade level was 22, 21, and 26, respectively. Unlike English/Language Arts, there does not appear to be obvious patterns in the number and percentage of standards at different DOK levels for Mathematics. Although visually less dramatic, there does seem to be a slight decrease in the percentage of standards at DOK level 1, and an increase in the number and percentage of standards at DOK Level 2 across grade levels. Finally, 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.

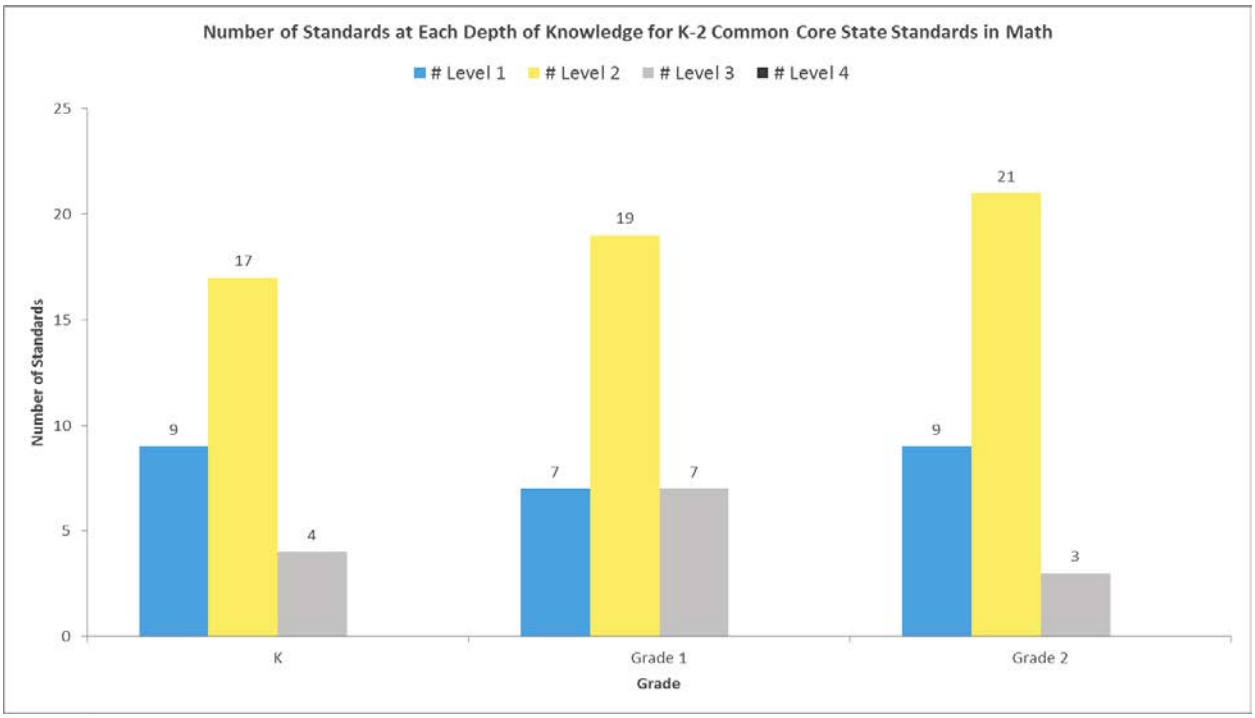


Figure 6. Number of standards at each Depth of Knowledge for Kindergarten through Grade Common Core standards in Mathematics

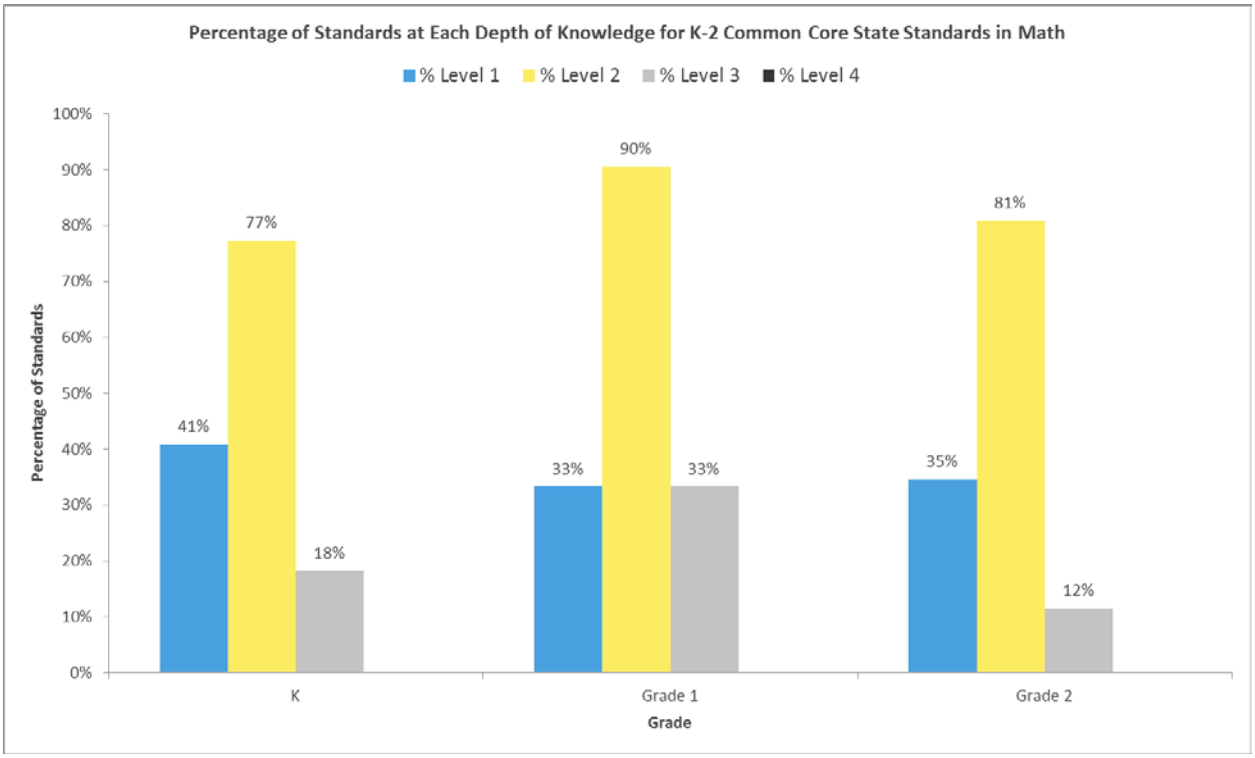


Figure 7. Percentage of standards at each Depth of Knowledge for Kindergarten through Grade Kindergarten through Grade Kindergarten through Grade Kindergarten through Grade2 Common Core standards in Mathematics

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

Additional standards to the Common Core were adopted for each grade level/span of the Iowa Core in the area of English/Language Arts. Across grades K-12, a total of 48 additional standards were adopted. There are 498 total Literacy standards in the Iowa Core, with the additional standards representing 9.6% of the total set of Literacy standards. Most of the Iowa-specific additions to the standards were at DOK Levels 2 and 3, with fewer at DOK Level 1 and none at DOK Level 4 (Figures 8 and 9).

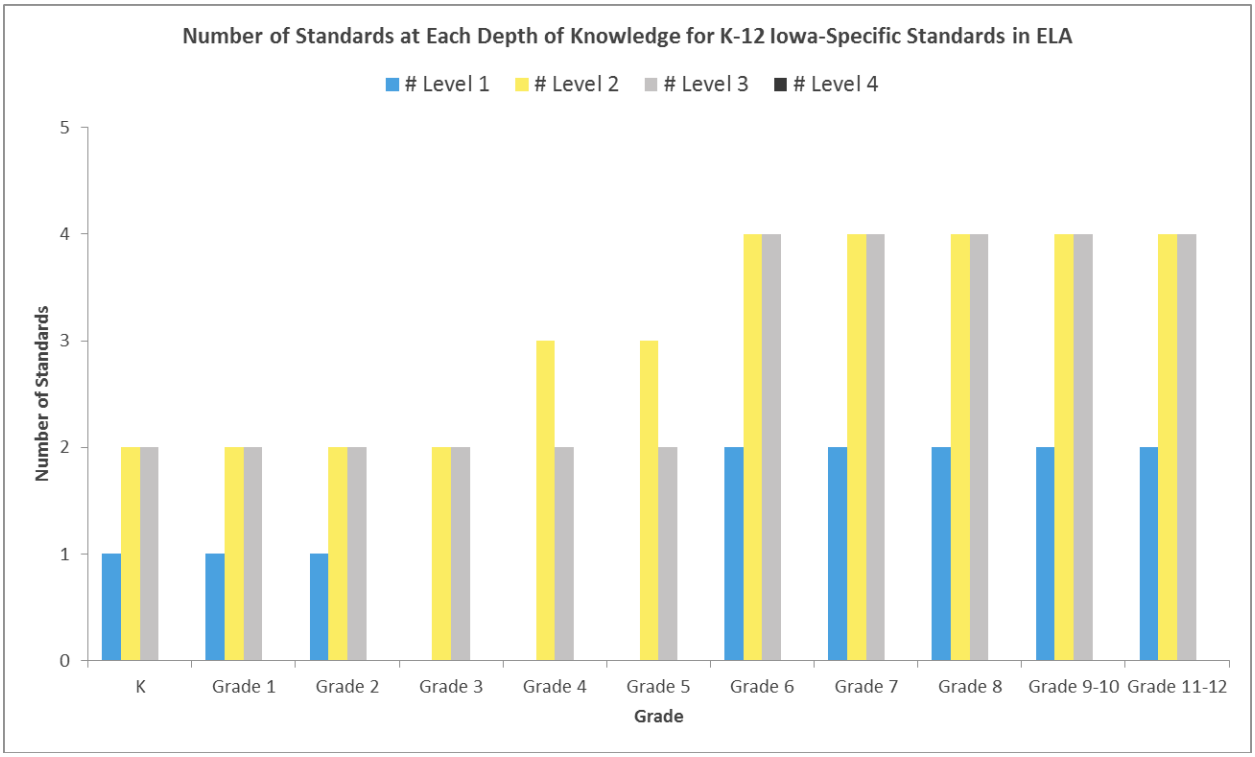


Figure 8. Number of standards at each Depth of Knowledge for Kindergarten through Grade 12 Iowa-specific additions in English/Language Arts

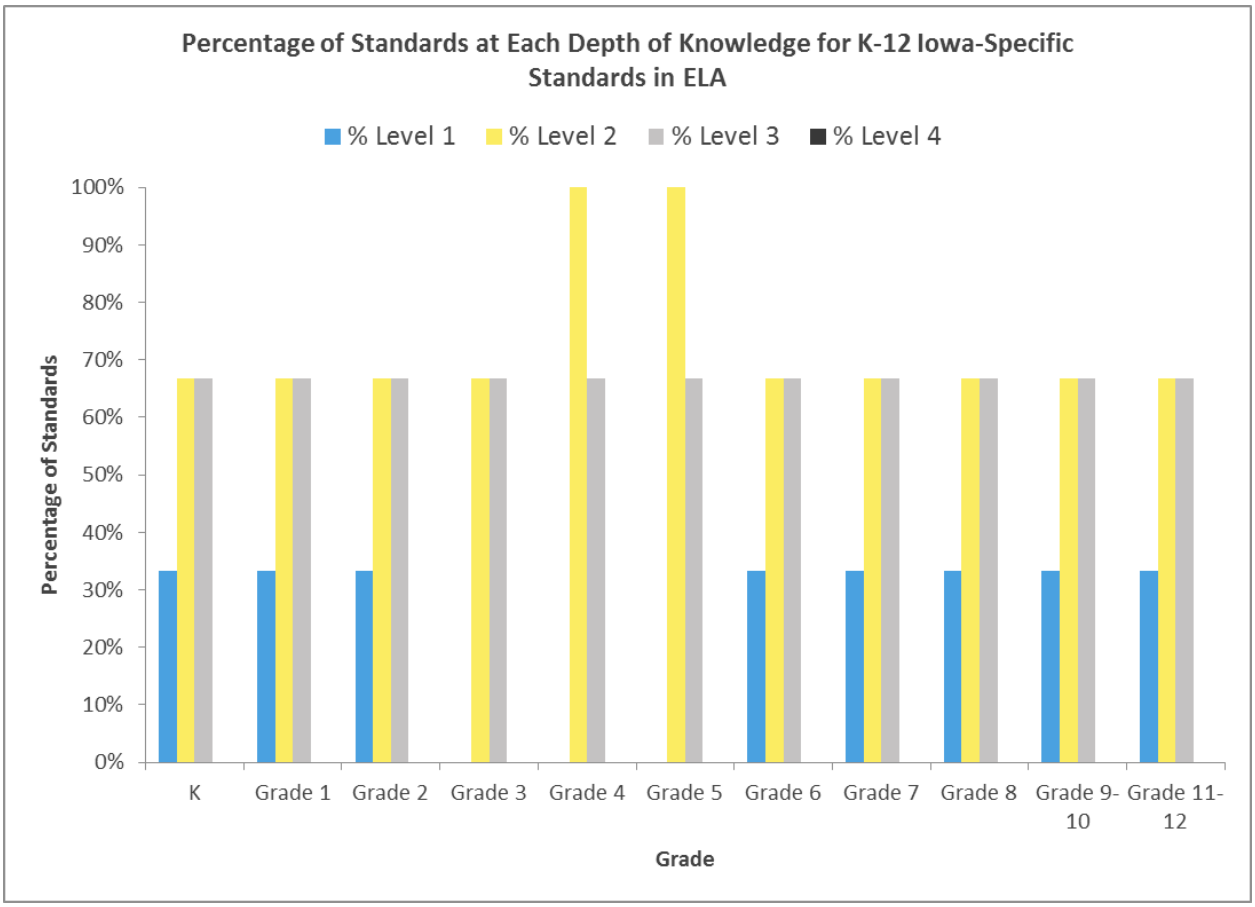


Figure 9. Percentage of standards at each Depth of Knowledge for Kindergarten through Grade 12 Iowa-specific additions in English/Language Arts

Additional standards to the Common Core were adopted for each grade level/span of the Iowa Core in the area of Mathematics in grade 2, High School: Number and Quantity, and High School: Geometry. A total of 10 additional standards were adopted. There are 395 total Mathematics standards in the Iowa Core, with the additional standards representing 2.5% of the total set of Mathematics standards. Most of the Iowa-specific additions to the standards were at DOK Levels 2 and 3, with the exception of standards for High School: Number and Quantity. While all of the added standards to this level were at DOK Levels 2 and 3, some of the added standards were also coded at DOK Level 1. None of the Iowa-specific additions were at DOK Level 4 (Figures 10 and 11).

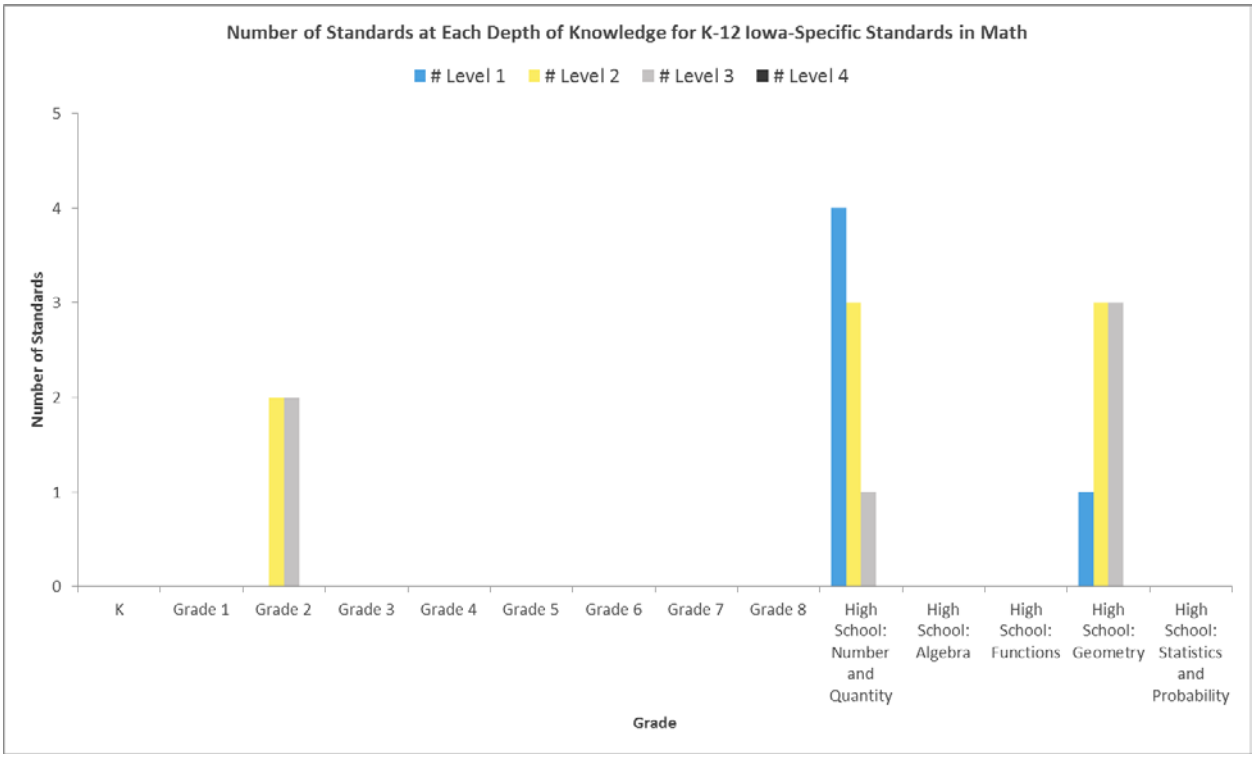


Figure 10. Number of standards at each Depth of Knowledge for Kindergarten through Grade 12 Iowa-specific additions in Mathematics

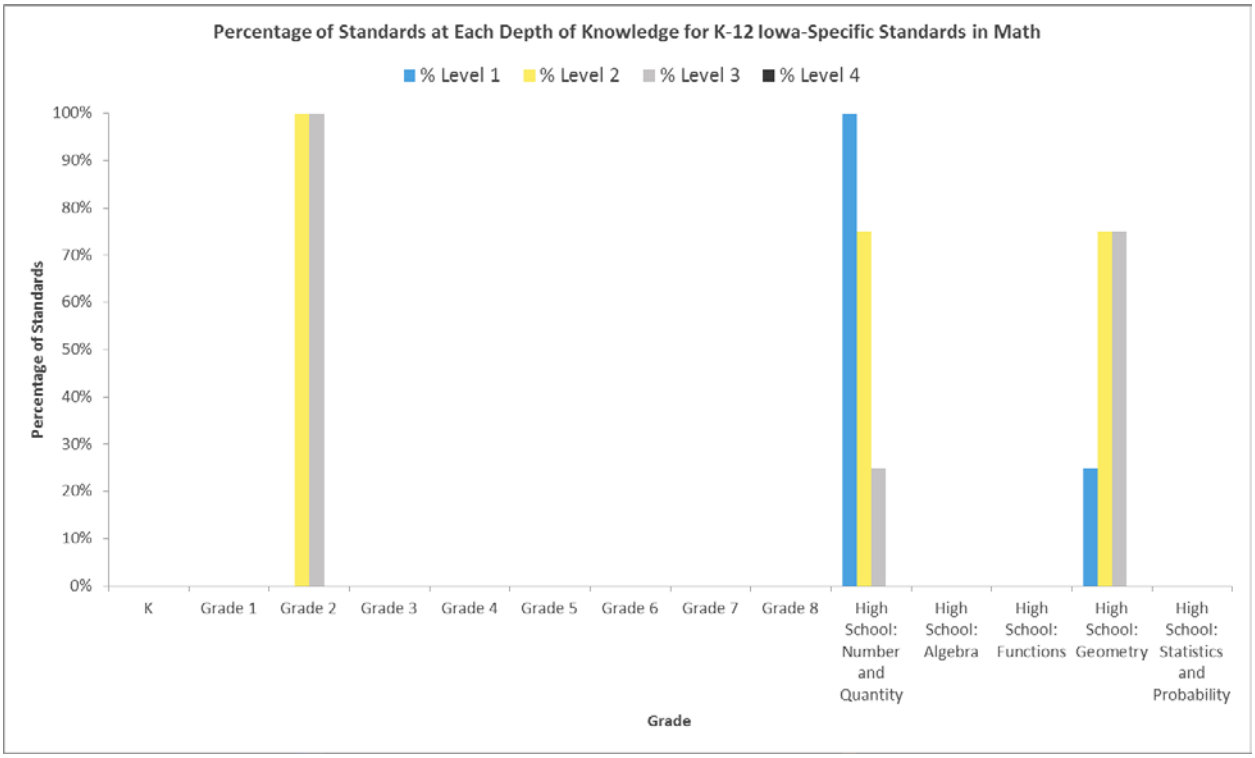


Figure 11. Percentage of standards at each Depth of Knowledge for Kindergarten through Grade 12 Iowa-specific additions in Mathematics

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

The number and percentage of standards at each DOK level in Literacy for the Iowa Core standards across grades K-12 are found in Figures 12 and 13, respectively. The total number of possible standards at each grade level is found in Table 5. Overall, it appears that the number and percentage of standards at DOK Level 1 decreases as grade level increases. Although this appears to be the general trend, there was an increase in DOK Level 1 standards from grades 2 to 3, and then a general decrease again through the grade span for 11-12. There appears to be a general increase in the number and percentage of standards at DOK Level 2 from kindergarten through grade 5, which then levels off through the grade 11-12 span. For DOK Level 3, there also appears to be a general increase in the number and percentage of standards through grade 6, which then levels off in a similar fashion to standards at DOK Level 2. There were no DOK Level 4 standards at grade levels K-2. There appears to be a general increase in the number and percentage of DOK Level 4 standards starting in grade three all the way through the grade 11-12 span.

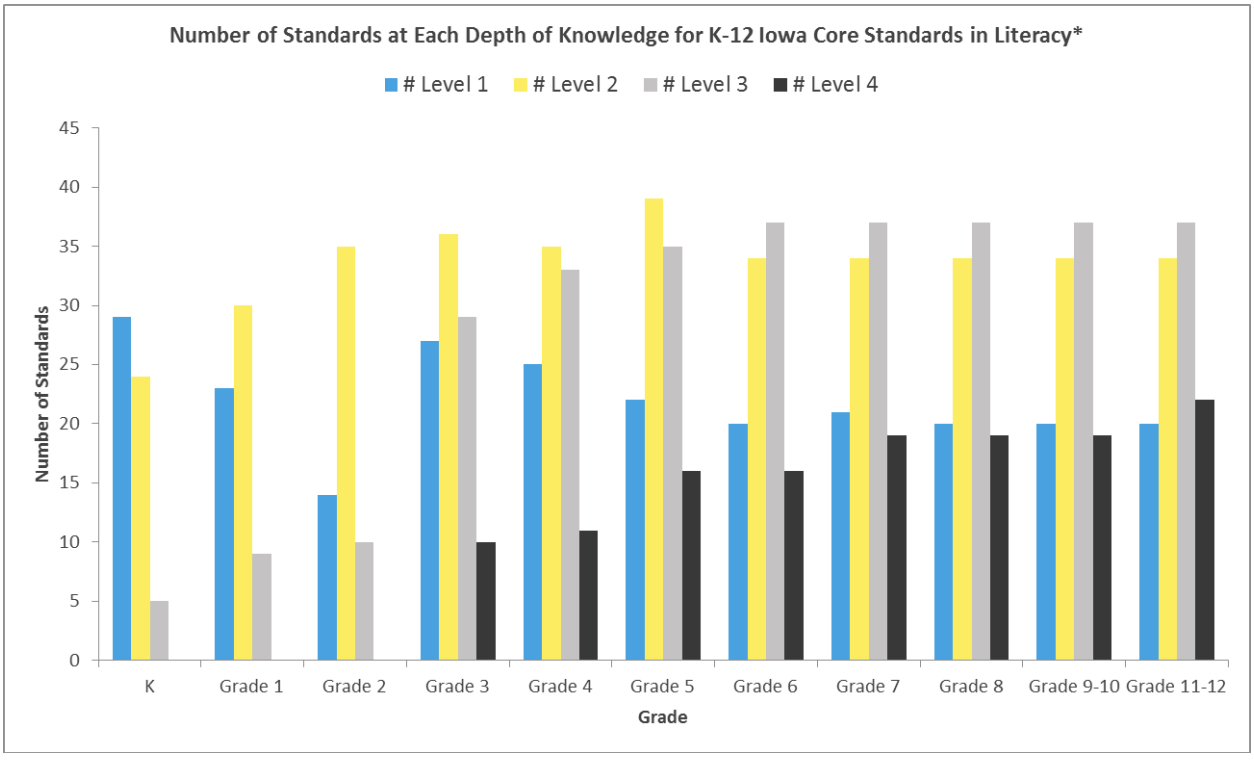


Figure 12. Number of standards at each Depth of Knowledge for Kindergarten through Grade 12 Iowa Core standards in Literacy.

*Results from the current study were combined with the results from the WestEd study (Sato, Lagunoff, & Worth (2011).

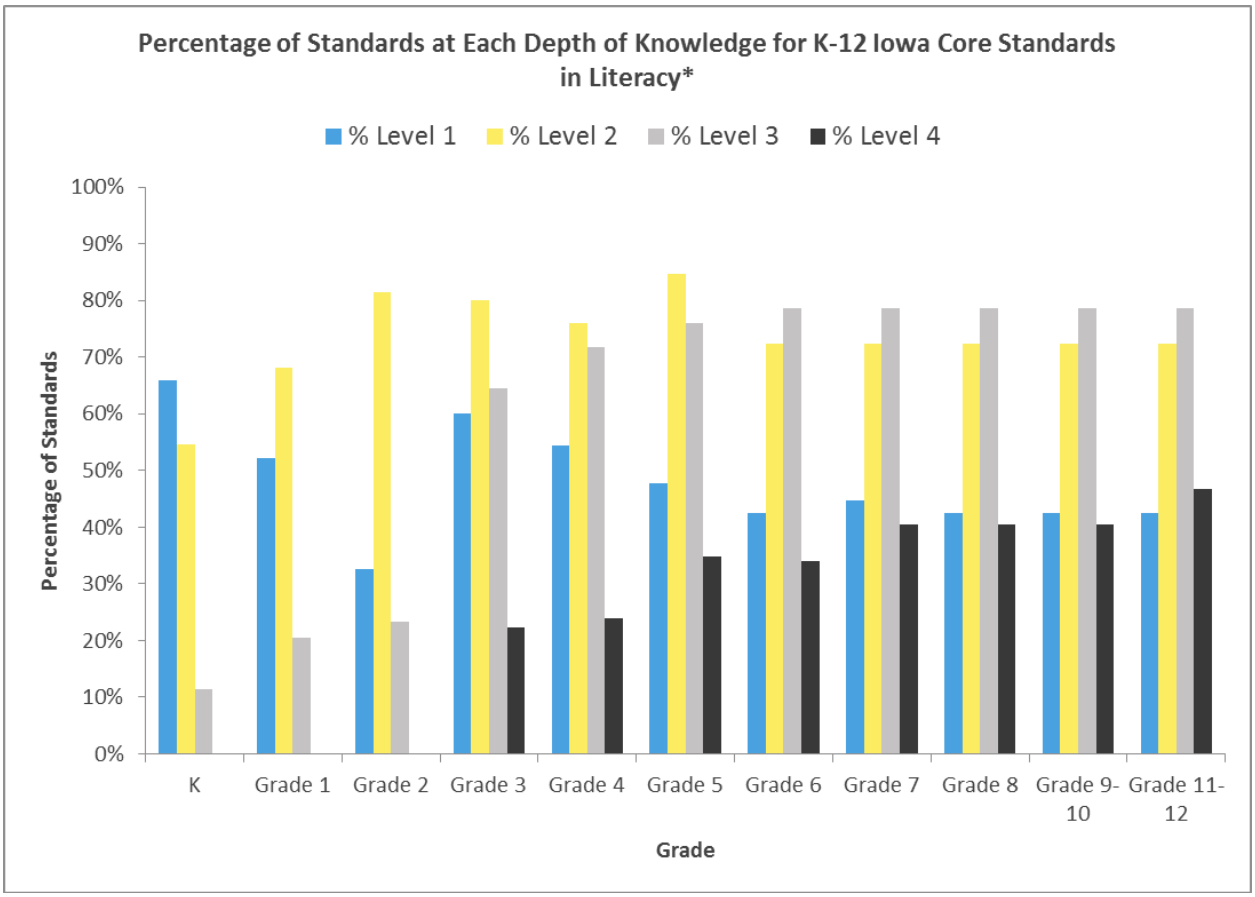


Figure 13. Percentage of standards at each Depth of Knowledge for Kindergarten through Grade 12 Iowa Core standards in Literacy

*Results from the current study were combined with the results from the WestEd study (Sato, Lagunoff, & Worth (2011).

Table 5. Depth of Knowledge for K-12 Iowa Core Standards in Literacy*

Grade	Total	# DOK 1	# DOK 2	# DOK 3	# DOK 4	% DOK 1	% DOK 2	% DOK 3	% DOK 4
Kindergarten	44	29	24	5	0	66%	55%	11%	0%
Grade 1	44	23	30	9	0	52%	68%	20%	0%
Grade 2	43	14	35	10	0	33%	81%	23%	0%
Grade 3	45	27	36	29	10	60%	80%	64%	22%
Grade 4	46	25	35	33	11	54%	76%	72%	24%
Grade 5	46	22	39	35	16	48%	85%	76%	35%
Grade 6	47	20	34	37	16	43%	72%	79%	34%
Grade 7	47	21	34	37	19	45%	72%	79%	40%
Grade 8	47	20	34	37	19	43%	72%	79%	40%
Grade 9-10	47	20	34	37	19	43%	72%	79%	40%
Grade 11-12	47	20	34	37	22	43%	72%	79%	47%
Totals	503	241	369	306	132	48%	73%	61%	26%

*Note: Coding data from this project were combined with the data collected in the WestEd study (Sato, Lagunoff,

& Worth (2011).

The number and percentage of standards at each DOK level in Mathematics for the Iowa Core standards across grades K-12 are found in Figures 14 and 15, respectively. The total number of possible standards at each grade level is found in Table 6. Overall, it appears that the number and percentage of standards at DOK Level 1 held relatively steady across grades K-2, then increased at grade 3. The number and percentage of DOK Level 1 standards then held relatively steady through grade 12, with slight dips at grade 7 and High School: Geometry. There is no apparent pattern for DOK Level 2 standards, with the number and percentage of standards at this level increasing and decreasing across different grade levels. For DOK Level 3, there is also an apparent lack of pattern across grade levels, though the number and percentage of standards at this level appear to be uniformly lower than the number and percentage of standards at DOK Levels 1 and 2. There were no DOK Level 4 standards at any grade level, with the exception of one standard in High School: Geometry.

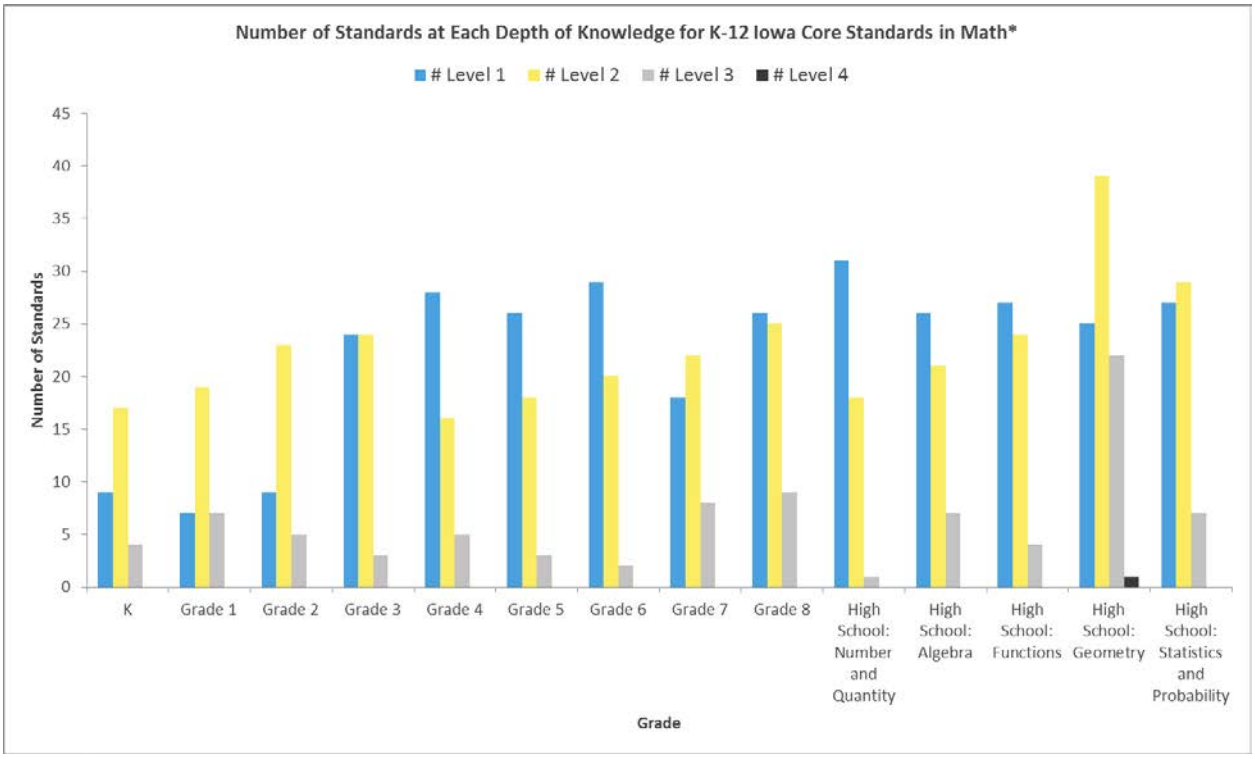


Figure 14. Number of standards at each Depth of Knowledge for Kindergarten through Grade 12 Iowa Core standards in Mathematics

*Results from the current study were combined with the results from the WestEd study (Sato, Lagunoff, & Worth (2011).

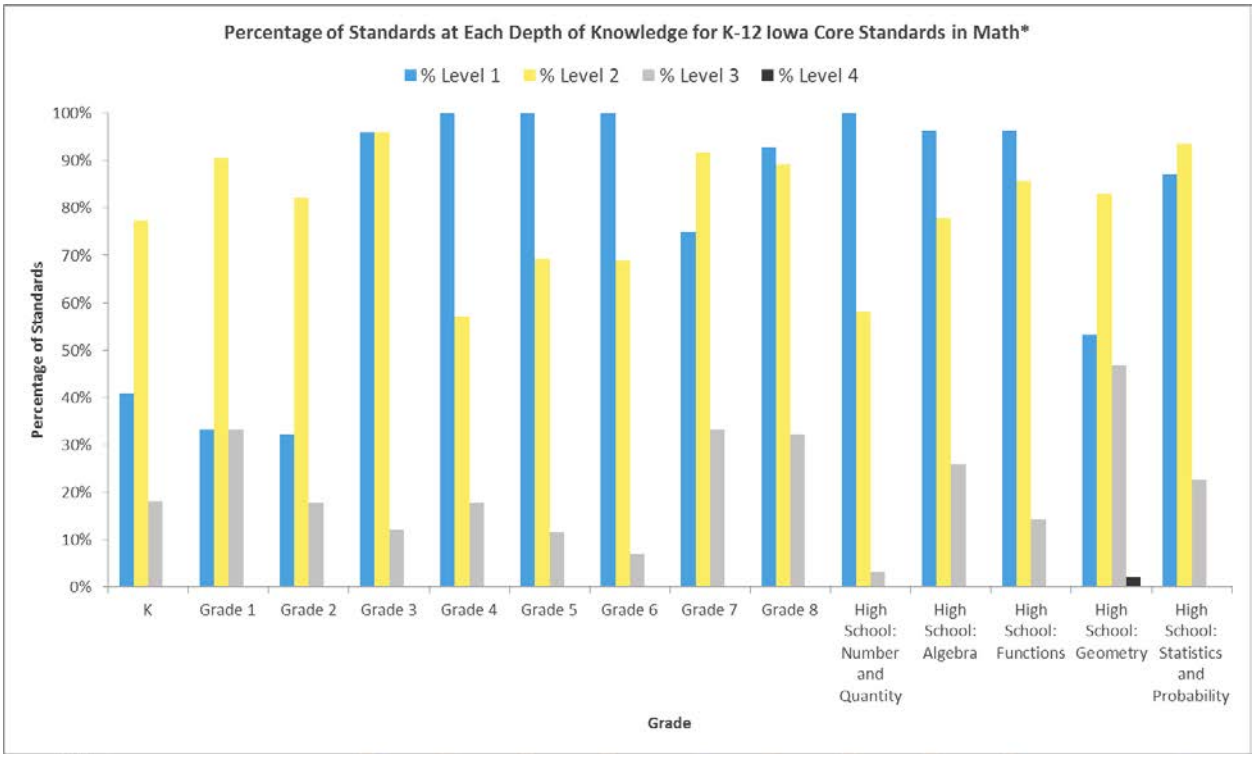


Figure 15. Percentage of standards at each Depth of Knowledge for Kindergarten through Grade 12 Iowa Core standards in Mathematics

*Results from the current study were combined with the results from the WestEd study (Sato, Lagunoff, & Worth (2011).

Table 6. Depth of Knowledge for K-12 Iowa Core Standards in Mathematics*

Grade	Total	# DOK 1	# DOK 2	# DOK 3	# DOK 4	% DOK 1	% DOK 2	% DOK 3	% DOK 4
Kindergarten	22	9	17	4	0	41%	77%	18%	0%
Grade 1	21	7	19	7	0	33%	90%	33%	0%
Grade 2	28	9	23	5	0	32%	82%	18%	0%
Grade 3	25	24	24	3	0	96%	96%	12%	0%
Grade 4	28	28	16	5	0	100%	57%	18%	0%
Grade 5	26	26	18	3	0	100%	69%	12%	0%
Grade 6	29	29	20	2	0	100%	69%	7%	0%
Grade 7	24	18	22	8	0	75%	92%	33%	0%
Grade 8	28	26	25	9	0	93%	89%	32%	0%
High School: Number and Quantity	31	31	18	1	0	100%	58%	3%	0%
High School: Algebra	27	26	21	7	0	96%	78%	26%	0%
High School: Functions	28	27	24	4	0	96%	86%	14%	0%
High School: Geometry	47	25	39	22	1	53%	83%	47%	2%
High School: Statistics and Probability	31	27	29	7	0	87%	94%	23%	0%

Totals	395	312	315	87	1	79%	80%	22%	0.3%

*Note: Coding data from this project were combined with the data collected in the WestEd study (Sato, Lagunoff, & Worth (2011).

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

Standard-level DOK codes for the Common Core standards grades K-2 and Iowa-specific additions K-12 for Literacy and Mathematics are found in Appendices F and G, respectively. Standard-level DOK codes for English/Language Arts and Mathematics grades 3-12 from the Common Core can be found in the WestEd study (Sato, Lagunoff, & Worth, 2011). Although the format of these data is slightly different between this report and the report by Sato and colleagues, standard-level DOK codes are still available in both.

Data Quality

Results from the 10-item CCCP End of Project Survey for all members from the Literacy team and both Mathematics teams are presented in Table 7. Team members provided ratings based a four-point, Likert scale, with 1 = Strongly Disagree and 4 = Strongly Agree. Members of both teams uniformly agreed to strongly-agreed with all survey items. There were no ratings below a three. The only items with a median and/or modal response of three were items eight and nine, which were related to coder perceptions regarding the comparability of their coding work to that found in the WestEd study (Sato, Lagunoff, & Worth, 2011).

Table 7. Summary of Coder Responses on the CCCP End of Project Survey by Team

Survey Item	Literacy Team			Math Team			Overall		
	Median	Mode	Range*	Median	Mode	Range*	Median	Mode	Range*
1. I understood the purpose(s) of the project.	4	4	-	4	4	-	4	4	-
2. I acquired the knowledge and skills I needed to successfully complete the project during the initial training.	4	4	3-4	4	4	3-4	4	4	3-4
3. I had sufficient practice and support to successfully complete the project.	4	4	3-4	4	4	-	4	4	3-4

4. The training session facilitator was knowledgeable about the project.	4	4	-	4	4	-	4	4	-
5. The training materials were helpful to me as I engaged in the project.	4	4	-	4	4	-	4	4	-
6. I implemented the project requirements with fidelity.	4	4	-	4	4	-	4	4	-
7. My coding decisions were similar to those of my coding teammates before consensus discussions.	4	4	3-4	4	4	3-4	4	4	3-4
8. I believe my coding decision making was similar to that of the WestEd study coders.	3	3	-	3.5	4	3-4	3	3	3-4
9. I believe the coding results from this study are comparable to the coding results from the WestEd study.	3	3	-	3.5	4	3-4	3	3	3-4
10. The amount of time scheduled by the project coordinators was sufficient to complete this project.	4	4	-	4	4	-	4	4	-

*Note: No range is provided when the high and low values were equal.

The percentage of agreement among raters was also calculated by comparing each possible rating pair for each standard. Coders had to indicate whether or not each of the four DOK levels was present or absent in each standard. This creates four "rating pairs" at which the two coders

could agree or disagree. In the example in Table 8, Coders 1 and 2 agreed on their DOK code assignments for the standard for DOK Levels 1, 3, and 4. That is, both raters agreed that the standard should be coded at DOK Level 1, but not for DOK Levels 3 and 4. Coders 1 and 2 disagreed on the DOK Level 2 rating, with Coder 1 believing that standard should not be coded at this level, while Coder 2 believed the standard should be coded at DOK Level 2. This resulted in three rating pair agreements for the standard and one rating pair disagreement, or a 75% rate of interrater agreement (Table 9).

Table 8. Example rating pair table for percent agreement determination

Standard	Grade	Rater 1				Rater 2			
		Level 1	Level 2	Level 3	Level 4	Level 1	Level 2	Level 3	Level 4
Reading Standards for LITERATURE K-5	K								
Key Ideas and Details	K								
1. With prompting and support, ask and answer questions about key details in a text.	K	x				x	x		

Table 9. Example agreement/disagreement rating pair display

Standard	Grade	Rater 1/Rater2 % Agreement				Number of Matches	Percent Matches
		Level 1	Level 2	Level 3	Level 4		
Reading Standards for LITERATURE K-5	K						
Key Ideas and Details	K						
1. With prompting and support, ask and answer questions about key details in a text.	K	Y	N	Y	Y	3	75%

For both Literacy and Mathematics, interrater agreement was calculated for all possible rater combinations and all coded standards (Figure 16). For Literacy, all two-coder interrater agreement was above 80%, with a three-coder interrater agreement of 76%. For Mathematics, interrater agreement was calculated within each of the two coding teams. All two-coder interrater agreement was above 80%, or close (Coders 2 and 3 from the Iowa-specific team agreed 78% of the time), with one exception. On the Iowa-specific team, Coders 1 and 2 only agreed 66% of the time. The three-coder interrater agreement was 77% and 63% for K-2 and Iowa-specific teams, respectively. With the two exceptions from the Iowa-specific Mathematics team, all interrater agreement was above the minimum threshold of 75% set for agreement between the teams and the WestEd study.

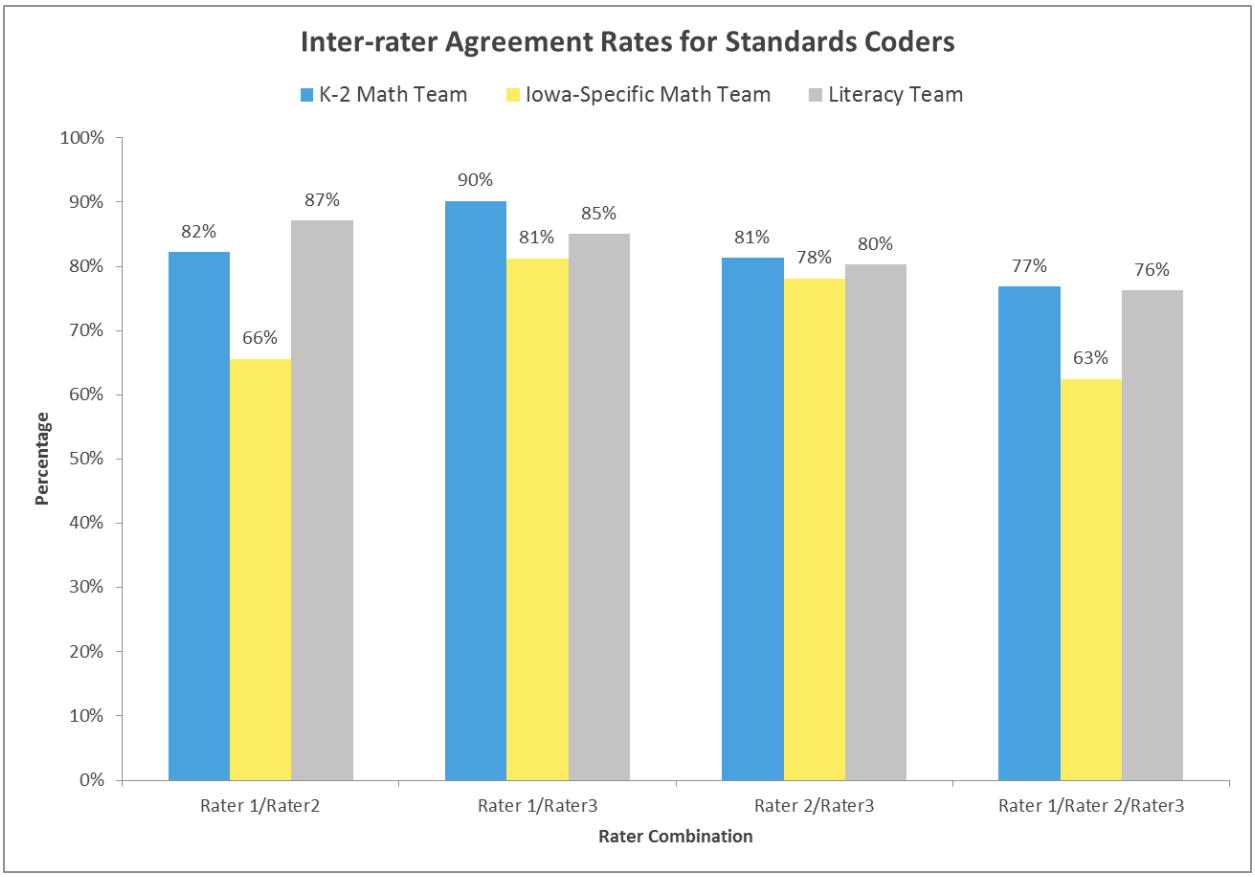


Figure 16. Percent agreement between coders for Literacy and Mathematics teams

If there was at least one disagreement for a standard for a three-coder comparison, teams were instructed to discuss their different perspectives on the DOK codes for that standard until consensus was reached (Table 10).

Table 10. Number and percentage of required coder consensus conversations by team

Team	K-2 Math Team	Iowa-Specific Math Team	Literacy Team
# of Consensus Conversations Needed	52	7	87
% of Consensus Conversations Needed	66%	88%	61%

Discussion

Interpretation of Results and Limitations of Study

The data collected for this study provided information to answer each of the four study questions.

Question 1: For Question 1, although 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. Although it is less clear at this time as to how developmentally appropriate these shifts in DOK across K-2 are, the notion that as students move through the school system, they should be expected to engage in more cognitively rigorous work would be supported by the overall trends in the data for Question 1.

Question 2: There were 48 Iowa-specific standards added to English/Language Arts across all grade levels/spans, and 10 for Mathematics. In regard to Question 2, 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. Although the number and percentages for each grade level/span were different for Mathematics than for English/Language Arts, the overall results were quite similar. That is, 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: In some ways, the data for Question 3 are similar to the data for Question 1. In general, there appears to be an increase in cognitive complexity/demand across grades K-12 for both Literacy and Mathematics. However, there are several differences as well. Unlike for the K-2 grade span, Literacy and Mathematics become less comparable for grades 3-12. For example, while the number and percentage of standards at DOK Level 1 decreased as grade level increased in Literacy, the number and percentage of standards at DOK Level 1 stayed relatively high after grade 2 in Mathematics. There also appears to be differences in the distribution pattern, or lack thereof, between Literacy and Mathematics beyond grade 2. There appears to be a general increase in the number and percentage of standards at DOK Levels 2 and 3 through grade 6 in Literacy, and then it levels off through grade 12. For Mathematics, it is difficult to detect any pattern in the number and percentage of Mathematics standards at DOK Levels 2 and 3 beyond grade 2. 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.

It is difficult to determine what caused some of the apparent differences between the codes for grades K-2 and the Iowa-specific additions, as well as between Literacy and Mathematics. Some of the differences may be attributable to the nature of the two content areas being different, or that different groups of people developed the two sets of standards. Differences could have occurred due to the coders from the present study approaching the coding task in a fundamentally different manner, or applying the process inconsistently.

Perhaps the criteria for consistency between coders from the WestEd study and the current study should have been greater than 75%. However, it should be noted that there are no interrater agreement data from the WestEd study (Sato, Lagunoff, & Worth, 2011). Furthermore, consensus conversations using Webb's DOK are a regular part of the process (e.g., Webb, 2005). Given the lack of interrater agreement data from the WestEd study and employing practices consistent with Webb's method, it is difficult to determine which group of coders, if any, was less consistent or accurate. There is no available evidence to suggest that a

more rigorous process of coding using Webb's consensus process should have been followed, nor is there available evidence to suggest a different method of setting a "good enough agreement" criterion should have been followed. It is therefore difficult to know how accurate the data in the current study are beyond the evidence collected.

It is also possible that more than three coders should have been used to code the standards. Webb (2007) recommends at least five coders be used when employing his process to conduct an alignment study to increase the degree of reliability of the results. However, it is also difficult to know the impact this would have had. First, the current study was not an alignment study, but instead just a coding of standards without comparisons. Furthermore, only two coders were used in the WestEd study (Sato, Lagunoff, & Worth, 2011). Without interrater agreement data from Webb (2007) or WestEd (Sato, Lagunoff, & Worth, 2011), it's impossible to know the extent to which the reliability of the data from this study was similar or different from those other studies. Overall, it seems justifiable to consider the data collected for this study to be of comparable reliability and accuracy to the data collected in the WestEd study.

Question 4: There is not a great deal of interpretation of the data collected for Question 4. Each standard has corresponding DOK assignments, which was what the results for Questions 1, 2, and 3 was based on. The resulting data tables for Question 4 have the data necessary to import into the I-CAT to add cognitive complexity/demand tools to that database.

It should be noted that visual analysis is a highly subjective method for interpreting the distribution of DOK code assignments. More statistically rigorous methods of determining distribution and trend (e.g., trendline analysis) would add increased confidence in the interpretation of results. With that said, the primary purpose of the study was not so much to describe the cognitive complexity/demand distribution (i.e., Questions 1, 2, and 3), but rather to get the standard level DOK codes (i.e., Question 4) to load into the I-CAT for future alignment analyses. As such, additional statistical rigor in interpreting patterns and trends in the data are not warranted.

Implications and Conclusion

Iowa Curriculum Alignment Toolkit (I-CAT)

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 I-CAT. The results of this study provide the Iowa Department of Education the information they need to make these updates. Specifically, the full set of standards in Iowa Core in Literacy and Mathematics have been assigned one or more cognitive complexity/demand codes using Webb's DOK framework. The next step in the process is to work with the programmer to design the file structure needed to import the DOK codes for the standards into the I-CAT. Once the cognitive complexity/ demand data are loaded into the I-CAT, work can be done to design new data input screens and reports teachers can obtain within the I-CAT to reflect on the cognitive complexity/demand of

their instruction. These new features will be field tested and adjusted as needed to create a tool that is of high quality for teachers and administrators.

Beyond the original purpose of this study, several implications can be drawn from the results. First, successful use of the cognitive complexity/demand features of the I-CAT will rely on several actions moving forward. For example, extensive training for teachers, administrators, AEA, and Department of Education staff is needed 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. Developing a deeper understanding of cognitive complexity/demand also has implications for instructional design and delivery, a few of the many practices that fall under the umbrella of Educator Quality (e.g., Glass, 2012). Tools like Standards Insight (CESA 7, 2011) could help with this effort if expanded to include the DOK codes.

Relatedly, using the DOK codes from the WestEd study (Sato, Lagunoff, & Worth, 2011) has implications for alignment with the assessed curriculum. Specifically, Iowa's membership in the Smarter Balance Assessment Consortium (SBAC) means that we now have access to the cognitive complexity/demand information that will be used to develop the SBAC assessments. Hopefully, information about SBAC can be integrated into the I-CAT in the future, allowing teachers access to data describing the degree of alignment between their enacted curriculum and the assessed curriculum of SBAC assessments.

Having DOK data in the I-CAT also opens up the possibility to expand its functionality even more, to include examinations of things like textbooks and related materials, online courses, and other instructional and assessment resources. Providing such information to teachers and administrators can be incredibly valuable to their decision-making process, helping them realize the vision set for by the Department of Education. Yet, there is still much to learn about the functionality of the I-CAT. For example, how can I-CAT data be used with student achievement data? Are I-CAT data predictive of student achievement, similar to the Surveys of Enacted curriculum (Gamoran et al., 1997)? How reliable are the I-CAT data? Very little information such as this is available for most of the alignment processes and tools out there today. We are well-positioned to start answering some of these questions.

As work continues to expand the function and features of the I-CAT related to cognitive complexity/demand (i.e., Phase 3, Figure 3), efforts should be made begin work in Phase 4 of the multi-pass roll out and engagement process. Phase 4 work focuses on the alignment dimension known as emphasis. *Emphasis* is "the extent to which topical/conceptual knowledge with accompanying complexity/demand are addressed by the intended, enacted, or assessed curriculum" (Niebling et al., 2008). For example, the I-CAT could be used to examine whether teachers spend a lot of time in their enacted curriculum on knowledge and skills that are frequently found in their assessed curriculum. Adding emphasis features to the I-CAT will allow that set of processes and tools to address the entire alignment framework used in the Iowa Core.

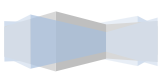
A Final Comment on Rigor

It is important to note that we cannot make any comparative statements about whether or not the Iowa Core in Literacy and Mathematics is more or less rigorous than some other set of standards. That is because we have no baseline or other comparative data to which we can compare the current set of data. For example, the Iowa School Boards Foundation (2009) conducted a study comparing the cognitive complexity/demand of the Iowa Core in Literacy, Mathematics, and Science at the high school level using Bloom's Revised Cognitive Taxonomy (e.g., Kratchwohl, 2002). While previous versions of the Iowa Core were examined in that study, a different cognitive complexity/demand framework was used than that for this study. As such, direct empirical comparisons with that study are not possible.

Webb's DOK framework has been used with numerous sets of state content standards since the late 1990s. Theoretically, comparisons could be made between the Iowa Core (or, perhaps more relevant to a wider audience, the Common Core State Standards) and these sets of standards. Indeed, part of the Iowa Technical Adequacy Project (ITAP) in the early 2000s was to code district standards and benchmarks according to a modified version of Webb's DOK framework (Frisbie, 2003). Notwithstanding potential problems with comparability between Webb's DOK and a modified version of Webb's DOK, there is still a problem with trying to make a determination about which set of standards are "more rigorous."

According to Webb (2007), "Currently, there are really no fixed guidelines as to what constitutes an acceptable progression in content complexity from grade to grade." The implication being that we do not have a firm set of guidelines as to what type of cognitive complexity/demand should be defined from grade to grade. Relatedly, it's unclear that more standards at higher levels of cognitive complexity/demand are necessarily better than few standards at higher levels of cognitive complexity/demand. Results from Porter et al. (2011a) indicate that the standards from other countries that typically outperform the United States on international benchmarking assessments spent more time on lower-level thinking skills than originally thought.

Perspectives such as these force us to carefully consider the balance between pursuing lower- and higher-order thinking from our students. Having a clear understanding the purpose of our education system in general, and the Iowa Core specifically, can help us work towards striking this balance. At the outset of this report, highlights from the Governor Branstad's and Director Glass' vision and legislative efforts, and how the Iowa Core fits into them, were offered. One of the foundations of the Governor's and Director's vision for education in Iowa is setting high expectations for students and having a system of assessments aligned to those learning expectations so we can monitor student learning at different points in their K-12 education career.



Alignment with something like ACT's College and Career Readiness standards and assessment system (ACT, 2011) 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 8-12. This is relevant, given the ability of the ACT results to predict performance for first-year college students (ACT, 2006). A great deal of work has been examining the connections between the Common Core and the ACT College and Career Readiness Standards, though not specifically examining cognitive complexity/demand (ACT, 2010). Nevertheless, this is one example of how we could determine whether or not the Iowa Core has a reasonable distribution of cognitive complexity/demand in the later grades.

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. For example, many well-developed systems of curriculum-based measures (CBMs) are built on the ability for those assessments to predict students' future performance on CBMs.

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 gives us a foundation upon which to build the important work of teachers, their students, and those that support them.

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Appendix A: Foundational Curriculum Terms Handout

Foundational Curriculum Terms: Definitions

Curriculum

Curriculum can be divided into three categories: intended, enacted, and assessed curricula (Porter, 2004)

- Intended curriculum: the content target for the enacted curriculum, often captured in content standards or other similar documents
- Enacted curriculum: the content actually delivered during instruction in the classroom and other learning settings, and how it is taught
- Assessed curriculum: the content that is assessed to determine achievement

Instruction

Instruction can be divided into two categories: instructional practices and instructional content (Porter & Smithson, 2001)

- Instructional practices: methods by which instructional content is delivered; how content is taught
- Instructional content: enacted curriculum students are exposed to and expected to acquire; what is actually taught

Assessment

A system of processes and tools that are used to determine the extent to which students are acquiring or have acquired the knowledge and skills listed in the curriculum and delivered via instruction (Niebling, et al., 2008) In general, there are four types of assessment decisions:

- Summative: Identifies student learning at a particular point in time, usually used to make cumulative decisions about student performance over a defined period of time
- Formative: Identifies if students are currently making progress and is used to help identify if instruction needs adjustment
- Screening: Identifies potential academic and/or behavioral concerns in need of additional assessment
- Diagnostic: Helps to determine why the academic and/or behavioral needs are occurring; identifies what the student needs to learn (Iowa Department of Education, 2008)

Content

The set of topics and corresponding cognitive demands as articulated through the intended curriculum (Iowa Department of Education, 2008)

Core Content Standards
Broad statements that identify the knowledge and skills students should acquire in reading, mathematics, science, and social studies; they remain constant throughout 3-12. (Department of Education, 2008)

Benchmarks
More detailed than the Core Content Standards, these are descriptors of a learning target for a span on grades, such as grades 3-5 (Iowa Department of Education, 2008)

Essential Concepts and Skill Sets
More detailed and comprehensive than standards and benchmarks, these are descriptions of what students should know and be able to do K-12 that are detailed in the Iowa Core Curriculum

Scope and Sequence
The arrangement of content over a period of time

Instructional materials
Instructional resources (e.g., textbooks, teacher-developed activities) that represent the content in the written curriculum and are used to engage students in the learning process (Niebling, et al., 2008)

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Appendix B: Foundational Alignment Terms Handout

Foundational Alignment Terms: Definitions

Alignment

The extent to which and how well all policy elements (e.g., content, instruction, and assessment) work together to guide instruction and, ultimately, facilitate and enhance student learning (Webb, 1997).

Directionality

The direction in which alignment is examined can be broken down into two Approaches (Niebling et al., 2008).

- Horizontal Alignment: degree of match across two components (e.g., instructional content with the Iowa Core Curriculum) within a single level (e.g., same grade comparisons).

- Vertical Alignment: degree of match within one component (e.g., district benchmark assessments) across multiple levels (e.g., across grade levels).

Dimensions

There are a wide variety of approaches to examining alignment (e.g., Surveys of Enacted Curriculum, Webb methods), each of which examine different aspects of alignment relationships. In general, these different aspects can be summarized along three dimensions, regardless of the methods used (Niebling et al., 2008).

- Topical/Conceptual Knowledge: Topics and information that student are supposed to learn.

- Cognitive Complexity/Demand: What students are expected to do with the topical/conceptual knowledge (e.g., Bloom's Taxonomy).

- Emphasis: The extent to which topical/conceptual knowledge with accompanying complexity/demand are addressed by the intended, enacted, or assessed curriculum.

Level of Analysis

When engaging in an examination of alignment in any direction, along any dimension(s), the specificity with which alignment is considered can vary along a continuum. This is referred to by Porter (2002) as "grain size."

- Coarse-Grained: Tends to be global or general in nature; "it's in there somewhere."

- Fine-Grained: Specific, targeted, one-to-one correspondence (Niebling et al., 2008).

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Appendix C: Cognitive Complexity Coding Project Manual

Cognitive Complexity Coding Project: Using Webb's Depth of Knowledge Framework to Code the Common Core Standards in English/Language Arts and Mathematics for Grades K-2 and Iowa-Specific Standards

Developed by Bradley C Niebling for the Iowa Department of Education

Table of Contents

Background Information

Since 2006, Iowa has been on a multi-year journey to invigorate our education system. The foundation of this effort has been the Iowa Core (formerly the Iowa Model Core Curriculum and Iowa Core Curriculum). The next step in this journey took place in July, 2010 when the Iowa State Board of Education unanimously voted (http://tinyurl.com/26este4) to adopt the Common Core State Standards (http://www.corestandards.org/) in English/Language Arts and Mathematics, K-12 (http://tinyurl.com/29sk3jg). The policy side of this work was completed in November, 20010 when the Iowa State Board of Education voted on additions to the Common Core adoption proposed by the Iowa Department of Education http://is.gd/PbMuFf. Collectively, in Iowa, the document is still called the Iowa Core.

More recently, Iowa Department of Education Director and "Head Learner" Jason Glass has worked with Iowa Governor Terry Branstad to develop a blueprint for the future of education in Iowa, entitled *One Unshakable Vision: World-Class Schools for Iowa*. This blueprint was further defined in a set of legislative recommendations set forth by Governor Branstad and Director Glass. A brief summary of the spirit behind these recommendations can be found here. A few points are worth mention at this point.

One of the foundations of the Governor's and Director's vision for education in Iowa is setting high expectations for students, and having a system of assessments aligned to those learning expectations so we can monitor student learning at different points in their K-12 education career. As explained on page 10 of the legislative recommendations brief, the Iowa Core is the centerpiece of defining those high

expectations for students. A statement like "high expectations" implicitly begs the question "high compared to what?"

Relatedly, Iowa recently joined the national assessment consortium SMARTER Balance. The purpose of SMARTER Balance is to develop assessments aligned with the Common Core to assess college and career readiness. SMARTER Balance helps fulfill the facets of the Governor's vision for education in the areas of assessing college and career readiness (e.g., pp. 11-12 of the legislative recommendations brief). As part of preparing for item development, SMARTER Balance commissioned a study to identify the cognitive complexity of the Common Core State Standards (Sato, Lagunoff, & Worth, 2011). Using cognitive complexity frameworks in this way is a method of determining "how high" standards are.

Alignment Implications

The adoption of the Common Core State Standards (i.e., "Common Core") has implications for several aspects of the Iowa Core implementation process for the Iowa Department of Education (i.e., the "DE"), Area Education Agencies (i.e., "AEAs"), and local districts. One of the biggest implications of the Common Core adoption is on work related to Outcome 4: Alignment.

Outcome 4 of the Iowa Core Implementation Plan framework requires districts to collect alignment data of the enacted-to-intended curriculum. Districts are to do so using two methods: (1) summative self-reporting, and (2) observation and dialogue. Here, I will focus on the first requirement, summative self-reporting. Heartland AEA 11, in collaboration with the DE and other AEAs, has been developing a summative self-reporting tool known as the Iowa Curriculum Alignment Toolkit (i.e., "I-CAT"). The I-CAT is a web-based tool that teachers can log into and enter data on what they have taught over the course of a school year, and how that relates to what is found in the Essential Concepts/Skill Sets and Details and/or Standards of the Iowa Core (http://tinyurl.com/2abe43l). The Common Core, as well as the Iowa-specific additions to the Iowa Core, for grades K-12 was integrated into the I-CAT in the spring of 2011.

With this integration into the I-CAT, educators in Iowa had a set of processes and tools they could use to fulfill the summative self-report requirement of Iowa Core Outcome 4. However, the vision for curriculum alignment, the I-CAT, and the Iowa Core has extended beyond Outcome 4 requirements from the beginning. A brief review of the vision for alignment work in Iowa can be found here. Briefly, to move the alignment work forward, beyond the minimum Outcome 4 requirements, it is time to start on Phase 3 of the multi-pass roll out and engagement process (Niebling, 2011). That requires the Iowa Core to be coded using a cognitive complexity framework, to integrate that coding into the I-CAT, and to build new features into the I-CAT to make use of the cognitive complexity codes.

Thankfully, we are able to access a resource that will both increase the quality of

our alignment work with the I-CAT in general, and more specifically expedite our cognitive complexity coding process. The SMARTER Balance Assessment Consortium (SBAC) commissioned WestEd to conduct a study of the Common Core to assist with future item development. Included in this study was a coding of the Common Core for grades 3-12 according to Norman Webb's Depth of Knowledge (DOK) criteria, a widely framework for examining the cognitive complexity of content standards and assessments (Webb, 2005).

Given widespread application and quality of Webb's DOK framework, Iowa's membership in SBAC, Iowa's desire to pursue higher expectations for students, the need to update the I-CAT to include cognitive complexity features, and the existing coding of the Common Core using Webb's DOK framework, we have decided to use Webb's DOK for inclusion of cognitive complexity features in the I-CAT. Since we only have DOK data available for grades 3-12 of the Common Core, additional DOK coding needs to occur for grades K-2 of the Common Core, as well as the Iowa-specific additions to the Iowa Core.

Method of Coding Standards According to Webb's DOK

Overview

Before beginning the Cognitive Complexity Coding Project (CCCP), a Facilitator should be obtained. The role of the Facilitator is to ensure the process is implemented with fidelity, and to answer any questions or troubleshoot issues during the session(s). Note that the Facilitator does not participate in actually reviewing the documents. The Facilitator is also responsible for bringing all of the tools and materials necessary to complete the process.

You will need the following tools and materials to engage in the Cognitive Complexity Coding Project (CCCP) process:

- A computer with an internet connection
- A Google account and/or Microsoft Excel
- A copy of the Iowa Core in your content area
- A copy of Webb's DOK for your content area (Appenices A and B of this document)

The CCCP is a eight-step process: (1) establish teams; (2) review purpose of the project; (3) become familiar with materials; (4) learn the coding process; (5) engage in calibration; (6) complete individual and consensus coding; (7) final preparation of documents; and (8) importing documents into the I-CAT.

Detailed Steps

Step 1: Establish Teams

Teams should have a minimum of three members. Team members must be familiar with the Iowa Core for their subject area. If team members are not, make sure time is taken for review of the Iowa Core, and for discussion to follow as necessary. If possible, having someone present who is an expert in the Iowa Core would be helpful.

Step 2: Review Purpose of the CCCP Process

Information available in the preceding paragraphs should be used to familiarize team members with the purpose of the CCCP process.

Step 3: Become Familiar with the Materials

During the orientation phase (if it hasn't been done already), the Facilitator(s) will provide participants with the links to the Google Spreadsheets and/or electronic files they need to complete the CCCP process, as well as the Iowa Core documents to be reviewed.

Step 4: Learn the Coding Process

Significant portions of the coding process have been taken, at times verbatim, from Norman Webb's Training Manual (2005). Some methodology is taken from the WestEd report of the DOK study of the Common Core (Sato, Lagunoff, & Worth, 2011). These two approaches have been blended for our cognitive complexity study.

The Process

The coding process you will follow is a six-step process, as follows:

a. Locate an electronic or hard copy of the Iowa Core for your content area and keep it handy.
b. Open the Google Spreadsheet assigned to you.
c. Using Webb's DOK framework, **independently** assign the DOK level(s) for each standard in your spreadsheet by places a lowercase "x" (without the quotation marks) in the appropriate column(s).
d. Once you have independently assigned DOK level(s) to your standards, engage

in
a consensus discussion with your teammates.

e. Document consensus decisions in Consensus Google Spreadsheet assigned to your team.

f. Email Brad Niebling (bniebling.milc@gmail.com) **and** Rita Martens (rita.martens@iowa.gov) when you have completed the consensus decisions for all of your assigned standards. Also email your content lead.

In order to develop a better understanding of the DOK levels, it is necessary to both review the level descriptions, engage with examples of using the DOK levels to code standards, and to engage in a calibration process with your teammates before doing your "official" standards coding. So, before you begin calibrating and coding, let's take some time learn more about Webb's DOK.

Understanding and Using the Depth-of-Knowledge (DOK) Levels

Interpreting and assigning DOK levels to standards is at the heart of the coding process. Before beginning the review and coding process itself, you should be adequately trained to identify, understand, and apply the different DOK levels for standards within your content area. Figure 1 below portrays the generic DOK level framework.

DOK Level	Title of Level
1	Recall
2	Skills and Concepts
3	Strategic Thinking
4	Extended Thinking

Figure 1. Generic depth of knowledge levels in Webb's DOK framework.

More detailed, content-specific DOK level descriptions can be found in Appendix A: Reading/Language Arts DOK Levels and Appendix B: Mathematics DOK Levels. Follow these steps now:

a. Take a few minutes to review the DOK framework for your content area by clicking
on the appropriate link before moving on to the next step.

b. Start by reviewing the level descriptions.

c. Then, review the example standards that follow the level descriptions. Try to guess
which DOK level should be assigned to each example standard. NO PEEKING!

d. Check your guesses against the answers provided after the example standards.
e. Once you are done reviewing the example standards and answers, go to Step 5: Engage in Calibration.

Once you have reviewed the DOK level descriptions and example ratings, you will move on to Step 5 in the coding process, calibration.

Step 5: Engage in Calibration

A. Each content-specific team will work together across all example standards to calibrate.

B. Each team member will independently assign DOK level(s) to the first example standard. The calibration spreadsheet for **Literacy** can be found at http://goo.gl/KPTrf, and for **Mathematics** at http://goo.gl/gYyCz.

C. Once each team member has finished coding the first example standard, they will copy and paste their independent DOK assignment(s) into the column(s) for them (identified by Rater #) in the **Consensus** sheet of their calibration spreadsheet.

D. Once the Consensus sheet is prepared with everyone's DOK assignment(s) for the first standard, the team will compare individual codings to the original standard and each other. A consensus- building conversation will follow, ensuring that the group decides on common DOK assignment(s), and are "calibrated" on the process.

E. One person from the team should be designated as the consensus recorder, and the team's consensus decision will be recorded in the "Consensus" column(s).

F. Once the consensus DOK assignment(s) have been entered in the appropriate column(s), the team will ask the Facilitator to enter in the WestEd Study DOK assignment(s) for the first standard into the consensus spreadsheet. Similarities and differences between the group's consensus DOK assignment(s) and the WestEd Study DOK assignment(s) will be discussed so the team can come to an understanding about those similarities and differences. DO NOT CHANGE YOUR CONSENSUS CODES. If discrepancies existed, we want to make sure they are documented.

This process will be repeated for all five example standards. The goal is for the consensus ratings of the team to be the same as the WestEd study DOK assignment(s). Specifically, teams need to have the same DOK assignment(s) as the WestEd study for at least 75% of the DOK assignment(s). If that goal is not accomplished, additional practice coding will need to take place until the team has the same coding as the WestEd study for three total standards. Questions may be asked of the Facilitator at this time as well; to make sure team members understand the cognitive complexity coding process.

Step 6: Complete Individual & Consensus Cognitive Complexity

Coding

A. Once the team is calibrated, team members will move on to independent DOK coding.

B. Each team member will be provided their own individual Google spreadsheet to conduct his or her independent DOK coding. Individuals need to obtain their Rater ID from the facilitator. Once you have your Rater ID, click on the appropriate link in the table below.

Literacy		Mathematics	
Rater 1	Rater 4	Rater 1	Rater 4
Rater 2	Rater 5	Rater 2	Rater 5
Rater 3	Rater 6	Rater 3	Rater 6

C. Teams will decide how frequently to work on consensus (e.g., by grade level).

D. Each team member will individually assign DOK code(s) to the Iowa Core standards for their assigned subject area and grade levels/spans.

E. Each team member will copy and paste their individual breakdowns into the Column for them (identified by Rater #) in the Consensus sheet. The consensus spreadsheet for **Literacy** can be found at <insert link> and for **Mathematics** at <insert link>.

D. Once the Consensus sheet is prepared, the team will compare individual DOK assignment(s). A consensus-building conversation will follow until the final DOK assignment(s) are developed and documented in the consensus spreadsheet.

This process will be repeated until all of the standards have been assigned one or more DOKs and consensus achieved. Once team members have finished the consensus process, they need to contact Brad Niebling (bniebling.milc@gmail.com) **and** Rita Martens (rita.martens@iowa.gov). You need to be finished by the beginning of March. If you have questions about timing and logistics, for **Literacy** contact Deb Hindman at Deb.Hindman@iowa.gov or for **Math**, contact Judith Spitzli at Judith.Spitzli@iowa.gov.

The following guidelines are helpful when considering which DOK level(s) to assign a standard:

- The primary purpose of the coding process is to identify the level of cognitive complexity in the Common Core/Iowa Core for teachers to use in reflecting on or planning for instruction. One specific application of this coding will be to include it in the I-CAT. Please note, this information may also be used by teachers, administrators, and/or test developers to assist with the development off assessment items/tasks. The latter of these purposes was the purpose of the WestEd study for grades 3-12.

- You can assign more than one DOK per standard, and you have to assign at least one per standard. Consider which DOK(s) are clearly represented in the standards. If you are not sure if a DOK level is present or not in a standard, do not indicate it as present. That is, leave that cell blank.

- The DOK level(s) of a standard should reflect the *complexity* of the standard, rather than its *difficulty*. The DOK level(s) describes the kind of thinking expected of students/involved in a task, not the likelihood that the task will be completed correctly.

- In assigning DOK level(s) to a standard, think about the complete domain of instruction/assessment items that would be appropriate for measuring the standard.

Step 7: Final Preparation of Documents

Once all of the cognitive complexity coding has been completed, the Facilitator will work with the I-CAT programmer and support staff to get the documents into the final format needed for import into the I-CAT..

Step 8: Import Documents into the I-CAT

Once the documents have been properly formatted and prepared, they will be sent to the I-CAT programmer and imported into the database.

References

Niebling, B. C. (2011). *Iowa Core alignment multi-pass roll out and engagement process*. Heartland Area Education Agency 11, Johnston, IA.

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Webb, N. (2005). Web Alignment Tool (WAT) Training Manual, Draft Version 1.1. Retrieved from http://wat.wceruw.org/index.aspx.

Webb, N. L. (2007). Issues related to judging the alignment of curriculum standards and assessments. *Applied Measurement in Education*, *20*, 7-25.

Appendix A. Reading/Language Arts DOK Levels

In language arts, four DOK levels were used to judge both reading and writing objectives and assessment tasks. The reading levels are based on Valencia and Wixson (2000, pp. 909–935). The writing levels were developed by Marshá Horton, Sharon O'Neal, and Phoebe Winter.

Reading Levels Descriptions

Reading Level 1

Level 1 requires students to receive or recite facts or to use simple skills or abilities. Oral reading that does not include analysis of the text, as well as basic comprehension

of a text, is included. Items require only a shallow understanding of the text presented and often consist of verbatim recall from text, slight paraphrasing of specific details from the text, or simple understanding of a single word or phrase. Some examples that represent, but do not constitute all of, Level 1 performance are:

- Support ideas by reference to verbatim or only slightly paraphrased details from the text.
- Use a dictionary to find the meanings of words.
- Recognize figurative language in a reading passage.

Reading Level 2

Level 2 includes the engagement of some mental processing beyond recalling or reproducing a response; it requires both comprehension and subsequent processing of text or portions of text. Inter-sentence analysis of inference is required. Some important concepts are covered, but not in a complex way. Standards and items at this level may include words such as summarize, interpret, infer, classify, organize, collect, display, compare, and determine whether fact or opinion. Literal main ideas are stressed. A Level 2 assessment item may require students to apply skills and concepts that are covered in Level 1. However, items require closer understanding of text, possibly through the item's paraphrasing of both the question and the answer. Some examples that represent, but do not constitute all of, Level 2 performance are:

- Use context cues to identify the meaning of unfamiliar words, phrases, and expressions that could otherwise have multiple meanings.
- Predict a logical outcome based on information in a reading selection.
- Identify and summarize the major events in a narrative.

Reading Level 3

Deep knowledge becomes a greater focus at Level 3. Students are encouraged to go beyond the text; however, they are still required to show understanding of the ideas in the text. Students may be encouraged to explain, generalize, or connect ideas. Standards and items at Level 3 involve reasoning and planning. Students must be able to support their thinking. Items may involve abstract theme identification, inference across an entire passage, or students' application of prior knowledge. Items may also involve more superficial connections between texts. Some examples that represent, but do not constitute all of, Level 3 performance are:

- Explain or recognize how the author's purpose affects the interpretation of a reading selection.
- Summarize information from multiple sources to address a specific topic.
- Analyze and describe the characteristics of various types of literature.

Reading Level 4

Higher-order thinking is central and knowledge is deep at Level 4. The standard or assessment item at this level will probably be an extended activity, with extended time provided for completing it. The extended time period is not a distinguishing factor if the required work is only repetitive and does not require the application of significant conceptual understanding and higher-order thinking. Students take information from at least one passage of a text and are asked to apply this information to a new task. They may also be asked to develop hypotheses and perform complex analyses of the connections among texts. Some examples that represent, but do not constitute all of, Level 4 performance are:

- Analyze and synthesize information from multiple sources.
- Examine and explain alternative perspectives across a variety of sources.
- Describe and illustrate how common themes are found across texts from different cultures.

Writing Level Descriptions

Writing Level 1

Level 1 requires the student to write or recite simple facts. The focus of this writing or recitation is not on complex synthesis or analysis, but on basic ideas. The students are asked to list ideas or words, as in a brainstorming activity, prior to written composition; are engaged in a simple spelling or vocabulary assessment; or are asked to write simple sentences. Students are expected to write, speak, and edit using the conventions of Standard English. This includes using appropriate grammar, punctuation, capitalization, and spelling. Students demonstrate a basic understanding and appropriate use of such reference materials as a dictionary, thesaurus, or Web site. Some examples that represent, but do not constitute all of, Level 1 performance are:

- Use punctuation marks correctly.
- Identify Standard English grammatical structures, including the correct use of verb tenses.

Writing Level 2

Level 2 requires some mental processing. At this level, students are engaged in first-draft writing or brief extemporaneous speaking for a limited number of purposes and audiences. Students are expected to begin connecting ideas, using a simple organizational structure. For example, students may be engaged in note-taking, outlining, or simple summaries. Text may be limited to one paragraph. Some examples that represent, but do not constitute all of, Level 2 performance are:

- Construct or edit compound or complex sentences, with attention to correct use of phrases and clauses.
- Use simple organizational strategies to structure written work.
- Write summaries that contain the main idea of the reading selection and pertinent details.

Writing Level 3

Level 3 requires some higher-level mental processing. Students are engaged in developing compositions that include multiple paragraphs. These compositions may include complex sentence structure and may demonstrate some synthesis and analysis. Students show awareness of their audience and purpose through focus, organization, and the use of appropriate compositional elements. The use of appropriate compositional elements includes such things as addressing chronological order in a narrative, or including supporting facts and details in an informational report. At this stage, students are engaged in editing and revising to improve the quality of the composition. Some examples that represent, but do not constitute all of, Level 3 performance are:

- Support ideas with details and examples.
- Use voice appropriate to the purpose and audience.
- Edit writing to produce a logical progression of ideas.

Writing Level 4

Higher-level thinking is central to Level 4. The standard at this level is a multi-paragraph composition that demonstrates the ability to synthesize and analyze complex ideas or themes. There is evidence of a deep awareness of purpose and audience. For example, informational papers include hypotheses and supporting evidence. Students are expected to create compositions that demonstrate a distinct voice and that stimulate the reader or listener to consider new perspectives on the addressed ideas and themes. An example that represents, but does not constitute all of, Level 4 performance is:

- Write an analysis of two selections, identifying the common theme and generating a purpose that is appropriate for both.

Sample Language Arts Objectives

Use the language arts DOK levels on the previous pages to determine the DOK levels for the following five sample objectives. When you are finished, turn the page to see whether you agree with the way we coded these objectives!

Objective 1

Identify cause and effect, and understand main idea and purpose implied by text.

Objective 2

Recall elements and details of story structure, such as sequence of events, character, plot, and setting.

Objective 3

Evaluate the relative accuracy and usefulness of information from different sources.

Objective 4

Apply knowledge of grammar and usage, including, but not limited to, parts of speech, punctuation marks, sentence structure, verb tense, and clauses and phrases.

Objective 5

Locate, gather, analyze and evaluate written information for the purpose of drafting a reasoned report that supports and appropriately illustrates references and conclusions drawn from research.

DOK Levels of the Sample Language Arts Objectives

Objective 1

Level 2. Students demonstrate their ability to do more than simply recall an explicitly stated main point. Here, students show basic reasoning skills (generally, understanding why something happens, or summarizing the main points) as they select a statement that best captures the informational emphasis of the article.

Objective 2

Level 1. Students recall specific information from the text.

Objective 3

Level 3. Students must understand a variety of kinds of texts, make inferences across entire passages, and demonstrate the ability to evaluate information according to various criteria. Students must be able to support their thinking.

Objective 4

Level 2. While using correct punctuation is generally a Level 1 activity, correct usage of clauses and phrases is a more complex activity. The range of activities for this objective then makes it a Level 2._

Objective 5

Level 4. Students must gather and analyze information over time, reasoning and supporting their conclusions. The prolonged nature of this research project, given its focus on higher-level analysis, make it a Level 4 objective.

Click here to go back to Step 5: Engage in Calibration

Appendix B. Mathematics DOK Levels

Math Level Descriptions

Level 1 (Recall)

includes the recall of information such as a fact, definition, term, or a simple procedure, as well as performing a simple algorithm or applying a formula. That is, in mathematics, a one-step, well defined, and straight algorithmic procedure should be included at this lowest level. Other key words that signify Level 1 include "identify," "recall," "recognize," "use," and "measure." Verbs such as "describe" and "explain" could be classified at different levels, depending on what is to be described and explained.

Level 2 (Skill/Concept)

includes the engagement of some mental processing beyond an habitual response. A Level 2 assessment item requires students to make some decisions as to how to approach the problem or activity, whereas Level 1 requires students to demonstrate a rote response, perform a well-known algorithm, follow a set procedure (like a recipe), or perform a clearly defined series of steps. Keywords that generally distinguish a Level 2 item include "classify," "organize," "estimate," "make observations," "collect and display data," and "compare data." These actions imply more than one step. For example, to compare data requires first identifying characteristics of objects or phenomena and then grouping or ordering the objects. Some action verbs, such as "explain," "describe," or "interpret," could be classified at different levels depending on the object of the action. For example, interpreting information from a simple graph, or reading information from the graph, also are at Level 2. Interpreting information from a complex graph that requires some decisions on what features of the graph need to be considered and how information from the graph can be aggregated is at Level 3. Level 2 activities are not limited only to number skills, but may involve visualization skills and probability skills. Other Level 2 activities include noticing or describing non-trivial patterns, explaining the purpose and use of experimental procedures; carrying out experimental procedures; making observations and collecting data; classifying, organizing, and comparing data; and organizing and displaying data in tables, graphs, and charts.

Level 3 (Strategic Thinking)

requires reasoning, planning, using evidence, and a higher level of thinking than the previous two levels. In most instances, requiring students to explain their thinking is at Level 3. Activities that require students to make conjectures are also at this level. The cognitive demands at Level 3 are complex and abstract. The complexity does not result from the fact that there are multiple answers, a possibility for both Levels 1 and 2, but because the task requires more demanding reasoning. An activity, however, that has more than one possible answer and requires students to justify the response they give would most likely be at Level 3.

Other Level 3 activities include drawing conclusions from observations; citing evidence and developing a logical argument for concepts; explaining phenomena in terms of concepts; and deciding which concepts to apply in order to solve a complex problem.

Level 4 (Extended Thinking)

requires complex reasoning, planning, developing, and thinking, most likely over an extended period of time. The extended time period is not a distinguishing factor if the required work is only repetitive and does not require applying significant conceptual understanding and higher-order thinking. For example, if a student has to take the water temperature from a river each day for a month and then construct a graph, this would be classified as a Level 2. However, if the student is to conduct a river study that requires taking into consideration a number of variables, this would be a Level 4. At Level 4, the cognitive demands of the task should be high and the work should be very complex. Students should be required to make several connections—relate ideas *within* the content area or *among* content areas—and have to select one approach among many alternatives on how the situation should be solved, in order to be at this highest level. Level 4 activities include designing *and* conducting experiments and projects; developing and proving conjectures, making connections between a finding and related concepts and phenomena; combining and synthesizing ideas into new concepts; and critiquing experimental designs.

Sample Mathematics Objectives

Use the mathematics DOK levels to determine the DOK levels for the following five sample objectives. When you are finished, turn the page to see whether you agree with the way *we* coded these objectives!

Objective 1

Read, write, and compare decimals in scientific notation.

Objective 2

(Grade 8) Solve two-step linear equations and inequalities in one variable over the rational numbers, interpret the solution or solutions in the context from which they arose, and verify the reasonableness of results.

Objective 3

(Grade 8, from the NEAP Mathematics Framework): Design a statistical experiment to study a problem and communicate the outcomes.

Objective 4

Compute with numbers (that is, add, subtract, multiply, divide).

Objective 5

Construct two-dimensional patterns for three-dimensional models, such as cylinders and cones.

DOK Levels of the Sample Mathematics Objectives

Objective 1

This objective is an example of Level 1. The highest demand for students to successfully meet this expectation requires them to use recall and use a routine method to convert a decimal to scientific notation.

Objective 2

This objective is an example of Level 3. The expectation expressed in this objective is that students will not only solve a two-step linear equation, but will also interpret the solution and verify the results. This will require students to do some reasoning in order to interpret the solution and could be fairly complex, depending on the context. If students were only required to solve linear equations and verify solutions, then the expectation would be Level 2.

Objective 3

To plan a statistical experiment, a student must define the problem and develop a procedure for solving it. This requires that the student identify the correct statistical model, apply the model to data, and communicate the outcome of the selected model. The student must interpret findings and make reasonable and rationed inferences from obtained data. This represents complex, multistep reasoning and reflects a Level 4 task.

Objective 4

This objective requires students to conduct basic calculations. This is Level 1 because it involves routine processing and involves a one-step process.

Objective 5

This objective is an example of Level 2. Although recognizing and drawing a two-dimensional pattern, or a regular cylinder, is expected to be routine (Level 1), building a three-dimensional model would not be as routine. It would require at least two steps: first, recognizing the shape and, second, drawing a two-dimensional object to reflect the shape in three dimensions.

Click here to go back to Step 5: Engage in Calibration

Appendix D: End-of-Study Coder Survey

Cognitive Complexity Coding Project End-of-Project Coder Survey

As a coder for the Cognitive Complexity Coding Project, your perspectives on the project are valuable not only to know how effective the project was, but on how we can make our work better in the future. Please take a few minutes to complete the survey below. Your answers may be used to describe the project in presentations or professional papers, but they WILL NOT be linked to you in any way. Please take a few minutes to complete this survey.

Coding Information

In this section, please share information related to what you coded for this project.

What content area did you code? *

- ELA
- Math

What was your coder ID number? *

If you can't remember, copy and paste this URL (http://goo.gl/hA2Pu) into a new browser window or tab and it will tell you. (NOTE: That means don't copy and paste the URL into THIS browser window or tab. Otherwise, you'll be taken away from this survey.

Background Information

Complete the questions below, indicating for each question the response(s) that best describe you as a professional educator.

What is the highest degree you have earned? *

- B.S/B.A.
- M.S./M.A
- Ed.S.
- Ph.D/Ed.D
- Other:

How many years have you been a professional eductor? *

Please enter the numerical digit that represents your time in education. For example, if you have been an educator for 13 years, enter 13, not thirteen.

What is your K-12 teaching experience? *

- I am currently a teacher
- I used to be a teacher
- I've never been a teacher

What is your current job/role in education? *
Check all that apply

- Classroom Teacher
- Building/District Administrator
- AEA or Dept of Ed Consultant
- Private Practice Consultant
- University-Based Educator
- Other
- I don't have a job in education

Respond to the following statement: "I consider myself to be a content area expert in the area I coded for this study." *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Session Feedback

In this section, please share your thoughts on matters related to the structure, process, and support of the coding project you completed.

1. I understood the purpose(s) of the project. *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Explain #1
If you have any additional comments that help explain your rating above, please provide them below.

2. I acquired the knowledge and skills I needed to successfully complete the project during the initial training. *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Explain #2
If you have any additional comments that help explain your rating above, please provide them below.

3. I had sufficient practice and support to successfully complete the project. *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Explain #3
If you have any additional comments that help explain your rating above, please provide them below.

4. The training session facilitator (Brad Niebling) was knowledgeable about the project. *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Explain #4
If you have any additional comments that help explain your rating above, please provide them below.

5. The training materials were helpful to me as I engaged in the project. *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Explain #5
If you have any additional comments that help explain your rating above, please provide them below.

6. I implemented the project requirements with fidelity. *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Explain #6
If you have any additional comments that help explain your rating above, please provide them below.

7. My coding decisions were similar to those of my coding teammates before consensus discussions. *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Explain #7
If you have any additional comments that help explain your rating above, please provide them below.

8. I believe my coding decision making was similar to that of the WestEd study coders. *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Explain #8
If you have any additional comments that help explain your rating above, please provide them below.

9. I believe the coding results from this study are comparable to the coding results from the WestEd study. *

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Explain #9
If you have any additional comments that help explain your rating above, please provide them below.

10. The amount of time scheduled by the project coordinators was sufficient to complete this project. *
Overall Project Coordinators: Rita Martens, Brad Niebling. ELA: Deb Hindman. Math: Judith Spitzli.

	1	2	3	4	
Strongly Disagree	○	○	○	○	Strongly Agree

Explain #10
If you have any additional comments that help explain your rating above, please provide them below.

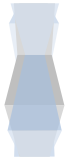
Please provide any additional comments you have about this study.

Appendix E: Coder Calibration Data

Literacy Team

Standard	Rater 1				Rater 2				Rater 3				Consensus				WestEd Codes				Match				Number of Matches	Number of Potential	Percent Matches
	Level 1	Level 2	Level 3	Level 4	Level 1	Level 2	Level 3	Level 4	Level 1	Level 2	Level 3	Level 4	Level 1	Level 2	Level 3	Level 4	Level 1	Level 2	Level 3	Level 4	Level 1	Level 2	Level 3	Level 4			
Reading Standards for Informational Text K-5 Key Ideas and Details																											
2. Determine the main idea of a text; recount the key details and explain how they support the main idea. (RI.3.2)		x	x		x	x	x			X				x	x			x	x		Y	Y	Y	Y	4	4	100%
Reading Standards: Foundational Skills K-5 Fluency																											
4. Read with sufficient accuracy and fluency to support comprehension. a. Read on-level text with purpose and understanding. b. Read on-level prose and poetry orally with accuracy, appropriate rate, and expression on successive readings. c. Use context to confirm or self-correct word recognition and understanding, rereading as necessary. (RF.5.4.)	x				x				X	X			X				x	x			Y	N	Y	Y	3	4	75%
Speaking and Listening Standards K-5 Presentation of Knowledge and Ideas																											
4. Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace. (SL.4.4.)		x	x			x	x				X			X	X		x	x	x		N	Y	Y	Y	3	4	75%
Language Standards K-5 Knowledge of Language																											
3. Use knowledge of language and its conventions when writing, speaking, reading, or listening. a. Choose words and phrases for effect. b. Recognize and observe differences between the conventions of spoken and written standard English. (L.3.3.)	x	x			x	x			X		X		X	X				x			Y	Y	N	Y	3	4	75%
Language Standards 6-12 Conventions of Standard English																											
2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing. a. Use a comma to separate coordinate adjectives (e.g., It was a fascinating, enjoyable movie but not He wore an old[,] green shirt). b. Spell correctly. (L.7.2.)	x				x				X	X			X				x				Y	Y	Y	Y	4	4	100%
																									17	20	85%

Standard	Rater 1				Rater 2				Rater 3				Consensus				WestEd Codes				Match				Number of Matches	Number of Potential Matches	Percent Matches
	Level 1	Level 2	Level 3	Level 4	Level 1	Level 2	Level 3	Level 4	Level 1	Level 2	Level 3	Level 4	Level 1	Level 2	Level 3	Level 4	Level 1	Level 2	Level 3	Level 4	Level 1	Level 2	Level 3	Level 4			
Operations and Algebraic Thinking Represent and solve problems involving multiplication and division.																											
1. Interpret products of whole numbers, e.g., interpret 5 × 7 as the total number of objects in 5 groups of 7 objects each. For example, describe a context in which a total number of objects can be expressed as 5 × 7. (3.OA.1.)	x	x				x			x				x	x			x	x			Y	Y	Y	Y	4	4	100%
Number and Operations—Fractions Apply and extend previous understandings of multiplication and division to multiply and divide fractions.																											
4. Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction. a. Interpret the product (a/b) × q as a parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations a × q ÷ b. For example, use a visual fraction model to show (2/3) × 4 = 8/3, and create a story context for this equation. Do the same with (2/3) × (4/5) = 8/15. (In general, (a/b) × (c/d) = ac/bd.) b. Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas. (5.NF.4.)		x	x			x	x		x	x				x				x	x			N	Y	Y	Y	3	4	75%
Geometry Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.																											
4. Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle. (7.G.4.)	x	x			x	x			x	x			x	x			x	x			Y	Y	Y	Y	4	4	100%
Creating Equations★ Solve systems of equations																											
6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. (A-REI.6.)	x				x	x			x				x				x	x			Y	N	Y	Y	3	4	75%
Interpreting Categorical and Quantitative Data Summarize, represent, and interpret data on two categorical and quantitative variables																											
6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models. b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association. (S-ID.6.)	x	x	x			x					x		x	x			x	x			Y	Y	Y	Y	4	4	100%
																									18	20	90%



Standard	Rater 4				Rater 5				Rater 6				Consensus				WestEd Codes				Match				Number of Matches	Number of Potential	Percent Matches
	Level 1	Level 2	Level 3	Level 4	Level 1	Level 2	Level 3	Level 4	Level 1	Level 2	Level 3	Level 4	Level 1	Level 2	Level 3	Level 4	Level 1	Level 2	Level 3	Level 4	Level 1	Level 2	Level 3	Level 4			
Operations and Algebraic Thinking Represent and solve problems involving multiplication and division.																											
1. Interpret products of whole numbers, e.g., interpret 5 × 7 as the total number of objects in 5 groups of 7 objects each. For example, describe a context in which a total number of objects can be expressed as 5 × 7. (3.OA.1.)		x				X				X				x			x	x			N	Y	Y	Y	3	4	75%
Number and Operations—Fractions Apply and extend previous understandings of multiplication and division to multiply and divide fractions.																											
4. Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction. a. Interpret the product (a/b) × q as a parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations a × q ÷ b. For example, use a visual fraction model to show (2/3) × 4 = 8/3, and create a story context for this equation. Do the same with (2/3) × (4/5) = 8/15. (In general, (a/b) × (c/d) = ac/bd.) b. Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas. (5.NF.4.)		X	X				X	X	X	X				X	X			x	x			N	Y	N	Y	2	4	50%
Geometry Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.																											
4. Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle. (7.G.4.)	X	X			X	X			x	x	x		X	X			x	x			Y	Y	Y	Y	4	4	100%
Creating Equations★ Solve systems of equations																											
6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. (A-REI.6.)	X				X	X			x				X				x	x			Y	N	Y	Y	3	4	75%
Interpreting Categorical and Quantitative Data Summarize, represent, and interpret data on two categorical and quantitative variables																											
6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models. b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association. (S-ID.6.)	X	X	X	X	X	X			x	x	x		X	X	X		x	x			Y	Y	N	Y	3	4	75%
																									15	20	75%

Appendix F: Standard-Level Depth of Knowledge Codes – Literacy

Table 11. Grade-level DOK ratings for the Iowa Core Literacy Standards (Common Core Grades K-2 & Iowa-specific additions K-12)

Standard	Grade	Level 1	Level 2	Level 3	Level 4
Reading Standards for LITERATURE K-5	K				
Key Ideas and Details	K	Level 1	Level 2	Level 3	Level 4
1. With prompting and support, ask and answer questions about key details in a text.	K	x			
2. With prompting and support, retell familiar stories, including key details.	K	x			
3. With prompting and support, identify characters, settings, and major events in a story.	K	x			
IA.1.Employ the full range of research-based comprehension strategies, including making connections, determining importance, questioning, visualizing, making inferences, summarizing, and monitoring for comprehension.	K		x	x	
Craft and Structure	K	Level 1	Level 2	Level 3	Level 4
4. Ask and answer questions about unknown words in a text.	K	x	x		
5. Recognize common types of texts (e.g., storybooks, poems).	K	x			
6. With prompting and support, name the author and illustrator of a story and define the role of each in telling the story.	K	x			
Integration of Knowledge and Ideas	K	Level 1	Level 2	Level 3	Level 4
7. With prompting and support, describe the relationship between illustrations and the story in which they appear (e.g., what moment in a story an illustration depicts).	K		x		
8. (Not applicable to literature)	K				
9. With prompting and support, compare and contrast the adventures and experiences of characters in familiar stories.	K		x		
Range of Reading and Level of Text Complexity	K				
10. Actively engage in group reading activities with purpose and understanding.	K				
Reading Standards for INFORMATIONAL TEXT K-5	K				
Key Ideas and Details	K	Level 1	Level 2	Level 3	Level 4

Standard	Grade	Level 1	Level 2	Level 3	Level 4
1. With prompting and support, ask and answer questions about key details in a text.	K	x			
2. With prompting and support, identify the main topic and retell key details of a text.	K	x			
3. With prompting and support, describe the connection between two individuals, events, ideas, or pieces of information in a text.	K		x		
IA.1.Employ the full range of research-based comprehension strategies, including making connections, determining importance, questioning, visualizing, making inferences, summarizing, and monitoring for comprehension.	K		x	x	
Craft and Structure	K	Level 1	Level 2	Level 3	Level 4
4. With prompting and support, ask and answer questions about unknown words in a text.	K	x			
5. Identify the front cover, back cover, and title page of a book.	K	x			
6. Name the author and illustrator of a text and define the role of each in presenting the ideas or information in a text.	K	x			
Integration of Knowledge and Ideas	K	Level 1	Level 2	Level 3	Level 4
7. With prompting and support, describe the relationship between illustrations and the text in which they appear (e.g., what person, place, thing, or idea in the text an illustration depicts).	K		x		
8. With prompting and support, identify the reasons an author gives to support points in a text.	K		x		
9. With prompting and support, identify basic similarities in and differences between two texts on the same topic (e.g., in illustrations, descriptions, or procedures).	K		x	x	
10. Actively engage in group reading activities with purpose and understanding.	K	x	x		
Reading Standards for FOUNDATIONAL SKILLS K-5	K				
Print Concepts	K	Level 1	Level 2	Level 3	Level 4
1. Demonstrate understanding of the organization and basic features of print.	K	x			

Standard	Grade	Level 1	Level 2	Level 3	Level 4
a. Follow words from left to right, top to bottom, and page by page.	K				
b. Recognize that spoken words are represented in written language by specific sequences of letters.	K				
c. Understand that words are separated by spaces in print.	K				
d. Recognize and name all upper- and lowercase letters of the alphabet.	K				
Phonological Awareness	K	Level 1	Level 2	Level 3	Level 4
2. Demonstrate understanding of spoken words, syllables, and sounds phonemes).	K	x			
a. Recognize and produce rhyming words.	K				
b. Count, pronounce, blend, and segment syllables in spoken words.	K				
c. Blend and segment onsets and rimes of single-syllable spoken words.	K				
d. Isolate and pronounce the initial, medial vowel, and final sounds (phonemes) in three-phoneme (consonent-vowel-consonent, or CVC) words.* (This does not include CVCs ending with /l/, /r/, or /x/.)	K				
e. Add or substitute individual sounds (phonemes) in simple, one-syllable words to make new words.	K				
* Words, syllables, or phonemes written in /slashes/refer to their pronunciation or phonology. Thus, /CVC/ is a word with three phonemes regardless of the number of letters in the spelling of the word.	K				
Phonics and Word Recognition	K	Level 1	Level 2	Level 3	Level 4
3. Know and apply grade-level phonics and word analysis skills in decoding words.	K	x			
a. Demonstrate basic knowledge of one-to-one letter-sound correspondences by producing the primary or many of the most frequent sound for each consonant.	K				
b. Associate the long and short sounds with common spellings (graphemes) for the five major vowels.	K				
c. Read common high-frequency words by sight (e.g., the, of, to, you, she, my, is, are, do, does).	K				

Standard	Grade	Level 1	Level 2	Level 3	Level 4
d. Distinguish between similarly spelled words by identifying the sounds of the letters that differ.	K				
Fluency	K	Level 1	Level 2	Level 3	Level 4
4. Read emergent-reader texts with purpose and understanding.	K	x			
Writing Standards K-5	K				
Text Types and Purposes	K	Level 1	Level 2	Level 3	Level 4
1. Use a combination of drawing, dictating, and writing to compose opinion pieces in which they tell a reader the topic or the name of the book they are writing about and state an opinion or preference about the topic or book (e.g., My favorite book is . . .).	K	x	x		
2. Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic.	K	x			
3. Use a combination of drawing, dictating, and writing to narrate a single event or several loosely linked events, tell about the events in the order in which they occurred, and provide a reaction to what happened.	K		x	x	
Production and Distribution of Writing	K	Level 1	Level 2	Level 3	Level 4
4. (Begins in grade 3)	K				
5. With guidance and support from adults, respond to questions and suggestions from peers and add details to strengthen writing as needed.	K		x	x	
6. With guidance and support from adults, explore a variety of digital tools to produce and publish writing, including in collaboration with peers.	K	x	x		
Research to Build and Present Knowledge	K	Level 1	Level 2	Level 3	Level 4
7. Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them).	K		x		
8. With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.	K	x	x		
9. (Begins in grade 4)	K				
Range of Writing	K				
10. (Begins in grade 3)	K				

Standard	Grade	Level 1	Level 2	Level 3	Level 4
Speaking and Listening Standards K-5	K				
Comprehension and Collaboration	K	Level 1	Level 2	Level 3	Level 4
1. Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.	K		x		
a. Follow agreed-upon rules for discussions (e.g., listening to others and taking turns speaking about the topics and texts under discussion).	K				
b. Continue a conversation through multiple exchanges.	K				
2. Confirm understanding of a text read aloud or information presented orally or through other media by asking and answering questions about key details and requesting clarifI-CATion if something is not understood.	K		x		
3. Ask and answer questions in order to seek help, get information, or clarify something that is not understood.	K		x		
Presentation of Knowledge and Ideas	K	Level 1	Level 2	Level 3	Level 4
4. Describe familiar people, places, things, and events and, with prompting and support, provide additional detail.	K	x			
5. Add drawings or other visual displays to descriptions as desired to provide additional detail.	K		x		
6. Speak audibly and express thoughts, feelings, and ideas clearly.	K	x	x		
IA.3.Recite familiar stories, poems, nursery rhymes, and lines of a play.	K	x			
Language Standards K-5	K				
Comprehension and Collaboration	K	Level 1	Level 2	Level 3	Level 4
1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.	K	x			
a. Print many upper- and lowercase letters.	K				
b. Use frequently occurring nouns and verbs.	K				
c. Form regular plural nouns orally by adding /s/ or /es/ (e.g., dog, dogs; wish, wishes).	K				
d. Understand and use question words (interrogatives) (e.g., who, what, where, when, why, how).	K				

Standard	Grade	Level 1	Level 2	Level 3	Level 4
e. Use the most frequently occurring prepositions (e.g., to, from, in, out, on, off, for, of, by, with).	K				
f. Produce and expand complete sentences in shared language activities.	K				
2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.	K	x			
a. Capitalize the first word in a sentence and the pronoun I.	K				
b. Recognize and name end punctuation.	K				
c. Write a letter or letters for most consonant and short-vowel sounds (phonemes).	K				
d. Spell simple words phonetically, drawing on knowledge of sound-letter relationships.	K				
Knowledge of Language	K				
3. (Begins in grade 2)	K				
Vocabulary Acquisition and Use	K	Level 1	Level 2	Level 3	Level 4
4. Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on kindergarten reading and content.	K	x	x		
a. Identify new meanings for familiar words and apply them accurately (e.g., knowing duck is a bird and learning the verb to duck).	K				
b. Use the most frequently occurring inflections and affixes (e.g., -ed, -s, re-, un-, pre-, -ful, -less) as a clue to the meaning of an unknown word.	K				
5. With guidance and support from adults, explore word relationships and nuances in word meanings.	K	x	x		
a. Sort common objects into categories (e.g., shapes, foods) to gain a sense of the concepts the categories represent.	K				
b. Demonstrate understanding of frequently occurring verbs and adjectives by relating them to their opposites (antonyms).	K				
c. Identify real-life connections between words and their use (e.g., note places at school that are colorful).	K				

Standard	Grade	Level 1	Level 2	Level 3	Level 4
d. Distinguish shades of meaning among verbs describing the same general action (e.g., walk, march, strut, prance) by acting out the meanings.	K				
6. Use words and phrases acquired through conversations, reading and being read to, and responding to texts.	K	x	x		
Reading Standards for LITERATURE K-5	1				
Key Ideas and Details	1	Level 1	Level 2	Level 3	Level 4
1. Ask and answer questions about key details in a text.	1	x	x		
2. Retell stories, including key details, and demonstrate understanding of their central message or lesson.	1	x	x		
3. Describe characters, settings, and major events in a story, using key details.	1	x			
IA.1.Employ the full range of research-based comprehension strategies, including making connections, determining importance, questioning, visualizing, making inferences, summarizing, and monitoring for comprehension.	1		x	x	
Craft and Structure	1	Level 1	Level 2	Level 3	Level 4
4. Identify words and phrases in stories or poems that suggest feelings or appeal to the senses.	1	x	x		
5. Explain major differences between books that tell stories and books that give information, drawing on a wide reading of a range of text types.	1		x	x	
6. Identify who is telling the story at various points in a text.	1		x		
Integration of Knowledge and Ideas	1				
7. Use illustrations and details in a story to describe its characters, setting, or events.	1		x		
8. (Not applicable to literature)	1				
9. Compare and contrast the adventures and experiences of characters in stories.	1		x		
Range of Reading and Level of Text Complexity	1				
10. With prompting and support, read prose and poetry of appropriate complexity for grade 1.	1				
Reading Standards for INFORMATIONAL TEXT K-5	1				
Key Ideas and Details	1	Level 1	Level 2	Level 3	Level 4

Standard	Grade	Level 1	Level 2	Level 3	Level 4
1. Ask and answer questions about key details in a text.	1	x	x		
2. Identify the main topic and retell key details of a text.	1	x			
3. Describe the connection between two individuals, events, ideas, or pieces of information in a text.	1		x		
IA.1.Employ the full range of research-based comprehension strategies, including making connections, determining importance, questioning, visualizing, making inferences, summarizing, and monitoring for comprehension.	1		x	x	
Craft and Structure	1	Level 1	Level 2	Level 3	Level 4
4. Ask and answer questions to help determine or clarify the meaning of words and phrases in a text.	1	x	x		
5. Know and use various text features (e.g., headings, tables of contents, glossaries, electronic menus, icons) to locate key facts or information in a text.	1	x			
6. Distinguish between information provided by pictures or other illustrations and information provided by the words in a text.	1		x		
Integration of Knowledge and Ideas	1	Level 1	Level 2	Level 3	Level 4
7. Use the illustrations and details in a text to describe its key ideas.	1		x		
8. Identify the reasons an author gives to support points in a text.	1		x		
9. Identify basic similarities in and differences between two texts on the same topic (e.g., in illustrations, descriptions, or procedures).	1			x	
Range of Reading and Level of Text Complexity	1				
10. With prompting and support, read informational texts appropriately complex for grade 1.	1				
Reading Standards for FOUNDATIONAL SKILLS K-5	1				
Print Concepts	1	Level 1	Level 2	Level 3	Level 4
1. Demonstrate understanding of the organization and basic features of print.	1	x			
a. Recognize the distinguishing features of a sentence (e.g., first word, capitalization, ending punctuation).	1				
Phonological Awareness	1	Level 1	Level 2	Level 3	Level 4

Standard	Grade	Level 1	Level 2	Level 3	Level 4
2. Demonstrate understanding of spoken words, syllables, and sounds (phonemes).	1	x			
a. Distinguish long from short vowel sounds in spoken single-syllable words.	1				
b. Orally produce single-syllable words by blending sounds (phonemes), including consonant blends.	1				
c. Isolate and pronounce initial, medial vowel, and final sounds (phonemes) in spoken single-syllable words.	1				
d. Segment spoken single-syllable words into their complete sequence of individual sounds (phonemes).	1				
Phonics and Word Recognition	1	Level 1	Level 2	Level 3	Level 4
3. Know and apply grade-level phonics and word analysis skills in decoding words.	1	x			
a. Know the spelling-sound correspondences for common consonant digraphs.	1				
b. Decode regularly spelled one-syllable words.	1				
c. Know final -e and common vowel team conventions for representing long vowel sounds.	1				
d. Use knowledge that every syllable must have a vowel sound to determine the number of syllables in a printed word.	1				
e. Decode two-syllable words following basic patterns by breaking the words into syllables.	1				
f. Read words with inflectional endings.	1				
g. Recognize and read grade-appropriate irregularly spelled words.	1				
Fluency	1	Level 1	Level 2	Level 3	Level 4
4. Read with sufficient accuracy and fluency to support comprehension.	1	x			
a. Read on-level text with purpose and understanding.	1				
b. Read on-level text orally with accuracy, appropriate rate, and expression on successive readings.	1				
c. Use context to confirm or self-correct word recognition and understanding, rereading as necessary.	1				

Standard	Grade	Level 1	Level 2	Level 3	Level 4
Writing Standards K-5	1				
Text Types and Purposes	1	Level 1	Level 2	Level 3	Level 4
1. Write opinion pieces in which they introduce the topic or name the book they are writing about, state an opinion, supply a reason for the opinion, and provide some sense of closure.	1		x		
2. Write informative/explanatory texts in which they name a topic, supply some facts about the topic, and provide some sense of closure.	1		x		
3. Write narratives in which they recount two or more appropriately sequenced events, include some details regarding what happened, use temporal words to signal event order, and provide some sense of closure.	1		x	x	
Production and Distribution of Writing	1	Level 1	Level 2	Level 3	Level 4
4. (Begins in grade 3)	1				
5. With guidance and support from adults, focus on a topic, respond to questions and suggestions from peers, and add details to strengthen writing as needed.	1		x	x	
6. With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers.	1		x		
Research to Build and Present Knowledge	1	Level 1	Level 2	Level 3	Level 4
7. Participate in shared research and writing projects (e.g., explore a number of "how-to" books on a given topic and use them to write a sequence of instructions).	1		x	x	
8. With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.	1	x	x		
9. (Begins in grade 4)	1				
Range of Writing	1				
10. (Begins in grade 3)	1				
Speaking and Listening Standards K-5	1				
Comprehension and Collaboration	1	Level 1	Level 2	Level 3	Level 4
1. Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups.	1		x	x	

Standard	Grade	Level 1	Level 2	Level 3	Level 4
a. Follow agreed-upon rules for discussions (e.g., listening to others with care, speaking one at a time about the topics and texts under discussion).	1				
b. Build on others' talk in conversations by responding to the comments of others through multiple exchanges.	1				
c. Ask questions to clear up any confusion about the topics and texts under discussion.	1				
2. Ask and answer questions about key details in a text read aloud or information presented orally or through other media.	1	x	x		
3. Ask and answer questions about what a speaker says in order to gather additional information or clarify something that is not understood.	1	x	x		
Presentation of Knowledge and Ideas	1	Level 1	Level 2	Level 3	Level 4
4. Describe people, places, things, and events with relevant details, expressing ideas and feelings clearly.	1	x	x		
5. Add drawings or other visual displays to descriptions when appropriate to clarify ideas, thoughts, and feelings.	1		x	x	
6. Produce complete sentences when appropriate to task and situation. (See grade 1 Language standard 1 for specific expectations.)	1	x			
IA.3.Recite familiar stories, poems, nursery rhymes, and lines of a play.	1	x			
Language Standards K-5	1				
Comprehension and Collaboration	1	Level 1	Level 2	Level 3	Level 4
1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.	1	x			
a. Print all upper- and lowercase letters.	1				
b. Use common, proper, and possessive nouns.	1				
c. Use singular and plural nouns with matching verbs in basic sentences (e.g., He hops; We hop).	1				
d. Use personal, possessive, and indefinite pronouns (e.g., I, me, my; they, them, their; anyone, everything).	1				

Standard	Grade	Level 1	Level 2	Level 3	Level 4
e. Use verbs to convey a sense of past, present, and future (e.g., Yesterday I walked home; Today I walk home; Tomorrow I will walk home).	1				
f. Use frequently occurring adjectives.	1				
g. Use frequently occurring conjunctions (e.g., and, but, or, so, because).	1				
h. Use determiners (e.g., articles, demonstratives).	1				
i. Use frequently occurring prepositions (e.g., during, beyond, toward).	1				
j. Produce and expand complete simple and compound declarative, interrogative, imperative, and exclamatory sentences in response to prompts.	1				
2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.	1	x			
a. Capitalize dates and names of people.	1				
b. Use end punctuation for sentences.	1				
c. Use commas in dates and to separate single words in a series.	1				
d. Use conventional spelling for words with common spelling patterns and for frequently occurring irregular words.	1				
e. Spell untaught words phonetically, drawing on phonemic awareness and spelling conventions.	1				
Knowledge of Language	1				
3. (Begins in grade 2)	1				
Vocabulary Acquisition and Use	1	Level 1	Level 2	Level 3	Level 4
4. Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 1 reading and content, choosing flexibly from an array of strategies.	1		x		
a. Use sentence-level context as a clue to the meaning of a word or phrase.	1				
b. Use frequently occurring affixes as a clue to the meaning of a word.	1				
c. Identify frequently occurring root words (e.g., look) and their inflectional forms (e.g., looks, looked, looking).	1				

Standard	Grade	Level 1	Level 2	Level 3	Level 4
5. With guidance and support from adults, demonstrate understanding of word relationships and nuances in word meanings.	1		x		
a. Sort words into categories (e.g., colors, clothing) to gain a sense of the concepts the categories represent.	1				
b. Define words by category and by one or more key attributes (e.g., a duck is a bird that swims; a tiger is a large cat with stripes).	1				
c. Identify real-life connections between words and their use (e.g., note places at home that are cozy).	1				
d. Distinguish shades of meaning among verbs differing in manner (e.g., look, peek, glance, stare, glare, scowl) and adjectives differing in intensity (e.g., large, gigantic) by defining or choosing them or by acting out the meanings.	1				
6. Use words and phrases acquired through conversations, reading and being read to, and responding to texts, including using frequently occurring conjunctions to signal simple relationships (e.g., because).	1	x	x		
Reading Standards for LITERATURE K-5	2				
Key Ideas and Details	2	Level 1	Level 2	Level 3	Level 4
1. Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.	2	x	x		
2. Recount stories, including fables and folktales from diverse cultures, and determine their central message, lesson, or moral.	2		x		
3. Describe how characters in a story respond to major events and challenges.	2		x		
IA.1.Employ the full range of research-based comprehension strategies, including making connections, determining importance, questioning, visualizing, making inferences, summarizing, and monitoring for comprehension.	2		x	x	
Craft and Structure	2	Level 1	Level 2	Level 3	Level 4
4. Describe how words and phrases (e.g., regular beats, alliteration, rhymes, repeated lines) supply rhythm and meaning in a story, poem, or song.	2		x		

Standard	Grade	Level 1	Level 2	Level 3	Level 4
5. Describe the overall structure of a story, including describing how the beginning introduces the story and the ending concludes the action.	2		x		
6. Acknowledge differences in the points of view of characters, including by speaking in a different voice for each character when reading dialogue aloud.	2		x		
Integration of Knowledge and Ideas	2	Level 1	Level 2	Level 3	Level 4
7. Use information gained from the illustrations and words in a print or digital text to demonstrate understanding of its characters, setting, or plot.	2		x		
8. (Not applicable to literature)	2				
9. Compare and contrast two or more versions of the same story (e.g., Cinderella stories) by different authors or from different cultures.	2			x	
Range of Reading and Level of Text Complexity	2				
10. By the end of the year, read and comprehend literature, including stories and poetry, in the grades 2–3 text complexity band proficiently, with scaffolding as needed at the high end of the range.	2				
Reading Standards for INFORMATIONAL TEXT K-5	2				
Key Ideas and Details	2	Level 1	Level 2	Level 3	Level 4
1. Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.	2	x	x		
2. Identify the main topic of a multiparagraph text as well as the focus of specific paragraphs within the text.	2		x		
3. Describe the connection between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text.	2		x		
IA.1.Employ the full range of research-based comprehension strategies, including making connections, determining importance, questioning, visualizing, making inferences, summarizing, and monitoring for comprehension.	2		x	x	
Craft and Structure	2	Level 1	Level 2	Level 3	Level 4

Standard	Grade	Level 1	Level 2	Level 3	Level 4
4. Determine the meaning of words and phrases in a text relevant to a grade 2 topic or subject area.	2		x		
5. Know and use various text features (e.g., captions, bold print, subheadings, glossaries, indexes, electronic menus, icons) to locate key facts or information in a text efficiently.	2	x			
6. Identify the main purpose of a text, including what the author wants to answer, explain, or describe.	2		x		
Integration of Knowledge and Ideas	2	Level 1	Level 2	Level 3	Level 4
7. Explain how specific images (e.g., a diagram showing how a machine works) contribute to and clarify a text.	2		x		
8. Describe how reasons support specific points the author makes in a text.	2		x		
9. Compare and contrast the most important points presented by two texts on the same topic.	2			x	
Range of Reading and Level of Text Complexity	2				
10. By the end of year, read and comprehend informational texts, including history/social studies, science, and technical texts, in the grades 2–3 text complexity band proficiently, with scaffolding as needed at the high end of the range.	2				
Reading Standards for FOUNDATIONAL SKILLS K-5	2				
Phonics and Word Recognition	2	Level 1	Level 2	Level 3	Level 4
3. Know and apply grade-level phonics and word analysis skills in decoding words.	2	x			
a. Distinguish long and short vowels when reading regularly spelled one-syllable words.	2				
b. Know spelling-sound correspondences for additional common vowel teams.	2				
c. Decode regularly spelled two-syllable words with long vowels.	2				
d. Decode words with common prefixes and suffixes.	2				
e. Identify words with inconsistent but common spelling-sound correspondences.	2				

Standard	Grade	Level 1	Level 2	Level 3	Level 4
f. Recognize and read grade-appropriate irregularly spelled words.	2				
Fluency	2	Level 1	Level 2	Level 3	Level 4
4. Read with sufficient accuracy and fluency to support comprehension	2	x			
a. Read on-level text with purpose and understanding.	2				
b. Read on-level text orally with accuracy, appropriate rate, and expression on successive readings.	2				
c. Use context to confirm or self-correct word recognition and understanding, rereading as necessary.	2				
Writing Standards K-5	2				
Text Types and Purposes	2	Level 1	Level 2	Level 3	Level 4
1. Write opinion pieces in which they introduce the topic or book they are writing about, state an opinion, supply reasons that support the opinion, use linking words (e.g., because, and, also) to connect opinion and reasons, and provide a concluding statement or section.	2		x	x	
2. Write informative/explanatory texts in which they introduce a topic, use facts and definitions to develop points, and provide a concluding statement or section.	2		x	x	
3. Write narratives in which they recount a well elaborated event or short sequence of events, include details to describe actions, thoughts, and feelings, use temporal words to signal event order, and provide a sense of closure.	2		x	x	
Production and Distribution of Writing	2	Level 1	Level 2	Level 3	Level 4
4. (Begins in grade 3)	2				
5. With guidance and support from adults and peers, focus on a topic and strengthen writing as needed by revising and editing.	2		x	x	
6. With guidance and support from adults, use a variety of digital tools to produce and publish writing, including in collaboration with peers.	2		x		
Research to Build and Present Knowledge	2	Level 1	Level 2	Level 3	Level 4
7. Participate in shared research and writing projects (e.g., read a number of books on a single topic to produce a report; record science observations).	2		x	x	

Standard	Grade	Level 1	Level 2	Level 3	Level 4
8. Recall information from experiences or gather information from provided sources to answer a question.	2	x	x		
9. (Begins in grade 4)	2				
Range of Writing	2				
10. (Begins in grade 3)	2				
Speaking and Listening Standards K-5	2				
Comprehension and Collaboration	2	Level 1	Level 2	Level 3	Level 4
1. Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.	2		x	x	
a. Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).	2				
b. Build on others' talk in conversations by linking their comments to the remarks of others.	2				
c. Ask for clarifI-CATion and further explanation as needed about the topics and texts under discussion.	2				
2. Recount or describe key ideas or details from a text read aloud or information presented orally or through other media.	2	x	x		
3. Ask and answer questions about what a speaker says in order to clarify comprehension, gather additional information, or deepen understanding of a topic or issue.	2		x		
Presentation of Knowledge and Ideas	2	Level 1	Level 2	Level 3	Level 4
4. Tell a story or recount an experience with appropriate facts and relevant, descriptive details, speaking audibly in coherent sentences.	2	x	x		
5. Create audio recordings of stories or poems; add drawings or other visual displays to stories or recounts of experiences when appropriate to clarify ideas, thoughts, and feelings.	2	x	x		
6. Produce complete sentences when appropriate to task and situation in order to provide requested detail or clarifI-CATion. (See grade 2 Language standards 1 and 3 specific expectations.)	2	x	x		
IA.3.Recite familiar stories, poems, nursery rhymes, and lines of a play.	2	x			

Standard	Grade	Level 1	Level 2	Level 3	Level 4
Language Standards K-5	2				
Comprehension and Collaboration	2	Level 1	Level 2	Level 3	Level 4
1. Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.	2	x	x		
a. Use collective nouns (e.g., group).	2				
b. Form and use frequently occurring irregular plural nouns (e.g., feet, children, teeth, mice, fish).	2				
c. Use reflexive pronouns (e.g., myself, ourselves).	2				
d. Form and use the past tense of frequently occurring irregular verbs (e.g., sat, hid, told).	2				
e. Use adjectives and adverbs, and choose between them depending on what is to be modified.	2				
f. Produce, expand, and rearrange complete simple and compound sentences (e.g., The boy watched the movie; The little boy watched the movie; The action movie was watched by the little boy).	2				
2. Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.	2	x			
a. Capitalize holidays, product names, and geographic names.	2				
b. Use commas in greetings and closings of letters.	2				
c. Use an apostrophe to form contractions and frequently occurring possessives.	2				
d. Generalize learned spelling patterns when writing words (e.g., cage → badge; boy → boil).	2				
e. Consult reference materials, including beginning dictionaries, as needed to check and correct spellings.	2				
Knowledge of Language	2				
3. Use knowledge of language and its conventions when writing, speaking, reading, or listening.	2	x			
a. Compare formal and informal uses of English.	2				
Vocab Acquisition & Usage	2	Level 1	Level 2	Level 3	Level 4

Standard	Grade	Level 1	Level 2	Level 3	Level 4
4. Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 2 reading and content, choosing flexibly from an array of strategies.	2		x		
a. Use sentence-level context as a clue to the meaning of a word or phrase.	2				
b. Determine the meaning of the new word formed when a known prefix is added to a known word (e.g., happy/unhappy, tell/retell).	2				
c. Use a known root word as a clue to the meaning of an unknown word with the same root (e.g., addition, additional).	2				
d. Use knowledge of the meaning of individual words to predict the meaning of compound words (e.g., birdhouse, lighthouse, housefly; bookshelf, notebook, bookmark).	2				
e. Use glossaries and beginning dictionaries, both print and digital, to determine or clarify the meaning of words and phrases.	2				
5. Demonstrate understanding of word relationships and nuances in word meanings.	2		x		
a. Identify real-life connections between words and their use (e.g., describe foods that are spicy or juicy).	2				
b. Distinguish shades of meaning among closely related verbs (e.g., toss, throw, hurl) and closely related adjectives (e.g., thin, slender, skinny, scrawny).	2				
6. Use words and phrases acquired through conversations, reading and being read to, and responding to texts, including using adjectives and adverbs to describe (e.g., When other kids are happy that makes me happy).)	2		x		
Reading Standards for LITERATURE K-5	3				
Key Ideas and Details	3	Level 1	Level 2	Level 3	Level 4
IA.1.Employ the full range of research-based comprehension strategies, including making connections, determining importance, questioning, visualizing, making inferences, summarizing, and monitoring for comprehension.	3		x	x	

Standard	Grade	Level 1	Level 2	Level 3	Level 4
Reading Standards for INFORMATIONAL TEXT K-5	3				
Key Ideas and Details	3	Level 1	Level 2	Level 3	Level 4
IA.1.Employ the full range of research-based comprehension strategies, including making connections, determining importance, questioning, visualizing, making inferences, summarizing, and monitoring for comprehension.	3		x	x	
Speaking and Listening Standards K-5	3				
Presentation of Knowledge and Ideas	3	Level 1	Level 2	Level 3	Level 4
IA.4.Perform dramatic readings and presentations.	3				
Reading Standards for LITERATURE K-5	4				
Key Ideas and Details	4	Level 1	Level 2	Level 3	Level 4
IA.1.Employ the full range of research-based comprehension strategies, including making connections, determining importance, questioning, visualizing, making inferences, summarizing, and monitoring for comprehension.	4		x	x	
Reading Standards for INFORMATIONAL TEXT K-5	4				
Key Ideas and Details	4	Level 1	Level 2	Level 3	Level 4
IA.1.Employ the full range of research-based comprehension strategies, including making connections, determining importance, questioning, visualizing, making inferences, summarizing, and monitoring for comprehension.	4		x	x	
Speaking and Listening Standards K-5	4				
Presentation of Knowledge and Ideas	4	Level 1	Level 2	Level 3	Level 4
IA.4.Perform dramatic readings and presentations.	4		x		
Reading Standards for LITERATURE K-5	5				
Key Ideas and Details	5	Level 1	Level 2	Level 3	Level 4
IA.1.Employ the full range of research-based comprehension strategies, including making connections, determining importance, questioning, visualizing, making inferences, summarizing, and monitoring for comprehension.	5		x	x	
Reading Standards for INFORMATIONAL TEXT K-5	5				
Key Ideas and Details	5	Level 1	Level 2	Level 3	Level 4

Standard	Grade	Level 1	Level 2	Level 3	Level 4
IA.1.Employ the full range of research-based comprehension strategies, including making connections, determining importance, questioning, visualizing, making inferences, summarizing, and monitoring for comprehension.	5		x	x	
Speaking and Listening Standards K-5	5				
Presentation of Knowledge and Ideas	5	Level 1	Level 2	Level 3	Level 4
IA.4.Perform dramatic readings and presentations.	5		x		
Reading Standards for Literature 6-12	6				
Key Ideas and Details	6	Level 1	Level 2	Level 3	Level 4
IA.1.Employ the full range of research-based comprehension strategies, including making connections, determining importance, questioning, visualizing, making inferences, summarizing, and monitoring for comprehension.	6		x	x	
IA.2.Read on-level text, both silently and orally, at an appropriate rate with accuracy and fluency to support comprehension.	6	x			
Reading Standards for Informational Text 6-12	6				
Key Ideas and Details	6	Level 1	Level 2	Level 3	Level 4
IA.1.Employ the full range of research-based comprehension strategies, including making connections, determining importance, questioning, visualizing, making inferences, summarizing, and monitoring for comprehension.	6		x	x	
IA.2.Read on-level text, both silently and orally, at an appropriate rate with accuracy and fluency to support comprehension.	6	x			
Speaking and Listening Standards 6-12	6				
Presentation of Knowledge and Ideas	6	Level 1	Level 2	Level 3	Level 4
IA.5.Prepare and conduct interviews.	6		x	x	
IA.6.Participate in public performances.	6		x	x	
Reading Standards for Literature 6-12	7				
Key Ideas and Details	7	Level 1	Level 2	Level 3	Level 4
IA.1.Employ the full range of research-based comprehension strategies, including making connections, determining importance, questioning, visualizing, making inferences, summarizing, and monitoring for	7		x	x	

Standard	Grade	Level 1	Level 2	Level 3	Level 4
comprehension.					
IA.2.Read on-level text, both silently and orally, at an appropriate rate with accuracy and fluency to support comprehension.	7	x			
Reading Standards for Informational Text 6-12	7				
Key Ideas and Details	7	Level 1	Level 2	Level 3	Level 4
IA.1.Employ the full range of research-based comprehension strategies, including making connections, determining importance, questioning, visualizing, making inferences, summarizing, and monitoring for comprehension.	7		x	x	
IA.2.Read on-level text, both silently and orally, at an appropriate rate with accuracy and fluency to support comprehension.	7	x			
Speaking and Listening Standards 6-12	7				
Presentation of Knowledge and Ideas	7	Level 1	Level 2	Level 3	Level 4
IA.5.Prepare and conduct interviews.	7		x	x	
IA.6.Participate in public performances.	7		x	x	
Reading Standards for Literature 6-12	8				
Key Ideas and Details	8	Level 1	Level 2	Level 3	Level 4
IA.1.Employ the full range of research-based comprehension strategies, including making connections, determining importance, questioning, visualizing, making inferences, summarizing, and monitoring for comprehension.	8		x	x	
IA.2.Read on-level text, both silently and orally, at an appropriate rate with accuracy and fluency to support comprehension.	8	x			
Reading Standards for Informational Text 6-12	8				
Key Ideas and Details	8	Level 1	Level 2	Level 3	Level 4
IA.1.Employ the full range of research-based comprehension strategies, including making connections, determining importance, questioning, visualizing, making inferences, summarizing, and monitoring for comprehension.	8		x	x	
IA.2.Read on-level text, both silently and orally, at an appropriate rate with accuracy and fluency to support comprehension.	8	x			

Standard	Grade	Level 1	Level 2	Level 3	Level 4
Speaking and Listening Standards 6-12	8				
Presentation of Knowledge and Ideas	8	Level 1	Level 2	Level 3	Level 4
IA.5.Prepare and conduct interviews.	8		x	x	
IA.6.Participate in public performances.	8		x	x	
Reading Standards for Literature 6-12	9-10				
Key Ideas and Details	9-10	Level 1	Level 2	Level 3	Level 4
IA.1.Employ the full range of research-based comprehension strategies, including making connections, determining importance, questioning, visualizing, making inferences, summarizing, and monitoring for comprehension.	9-10		x	x	
IA.2.Read on-level text, both silently and orally, at an appropriate rate with accuracy and fluency to support comprehension.	9-10	x			
Reading Standards for Informational Text 6-12	9-10				
Key Ideas and Details	9-10	Level 1	Level 2	Level 3	Level 4
IA.1.Employ the full range of research-based comprehension strategies, including making connections, determining importance, questioning, visualizing, making inferences, summarizing, and monitoring for comprehension.	9-10		x	x	
IA.2.Read on-level text, both silently and orally, at an appropriate rate with accuracy and fluency to support comprehension.	9-10	x			
Speaking and Listening Standards 6-12	9-10				
Presentation of Knowledge and Ideas	9-10	Level 1	Level 2	Level 3	Level 4
IA.5.Prepare and conduct interviews.	9-10		x	x	
IA.6.Participate in public performances.	9-10		x	x	
Reading Standards for Literature 6-12	11-12				
Key Ideas and Details	11-12	Level 1	Level 2	Level 3	Level 4
IA.1.Employ the full range of research-based comprehension strategies, including making connections, determining importance, questioning, visualizing, making inferences, summarizing, and monitoring for comprehension.	11-12		x	x	
IA.2.Read on-level text, both silently and orally, at an appropriate rate with accuracy and fluency to support comprehension.	11-12	x			
Reading Standards for Informational Text 6-12	11-12				

Standard	Grade	Level 1	Level 2	Level 3	Level 4
Key Ideas and Details	11-12	Level 1	Level 2	Level 3	Level 4
IA.1.Employ the full range of research-based comprehension strategies, including making connections, determining importance, questioning, visualizing, making inferences, summarizing, and monitoring for comprehension.	11-12		x	x	
IA.2.Read on-level text, both silently and orally, at an appropriate rate with accuracy and fluency to support comprehension.	11-12	x			
Speaking and Listening Standards 6-12	11-12				
Presentation of Knowledge and Ideas	11-12	Level 1	Level 2	Level 3	Level 4
IA.5.Prepare and conduct interviews.	11-12		x	x	
IA.6.Participate in public performances.	11-12		x	x	

Appendix G: Standard-Level Depth of Knowledge Codes – Mathematics

Table 12. Grade-level DOK ratings for the Iowa Core Mathematics Standards (Common Core Grades K-2 & Iowa-specific additions K-12)

Standard	Grade	Level 1	Level 2	Level 3	Level 4
Counting and Cardinality	K				
Know number names and the count sequence.	K	Level 1	Level 2	Level 3	Level 4
1. Count to 100 by ones and by tens.	K	x			
2. Count forward beginning from a given number within the known sequence (instead of having to begin at 1).	K	x	x		
3. Write numbers from 0 to 20. Represent a number of objects with a written numeral 0-20 (with 0 representing a count of no objects).	K	x			
Count to tell the number of object.	K	Level 1	Level 2	Level 3	Level 4
4. Understand the relationship between numbers and quantities; connect counting to cardinality.	K		x		
a. When counting objects, say the number names in the standard order, pairing each object with one and only one number name and each number name with one and only one object.	K				
b. Understand that the last number name said tells the number of objects counted. The number of objects is the same regardless of their arrangement or the order in which they were counted.	K				
c. Understand that each successive number name refers to a quantity that is one larger.	K				
5. Count to answer "how many?" questions about as many as 20 things arranged in a line, a rectangular array, or a circle, or as many as 10 things in a scattered configuration; given a number from 1–20, count out that many objects.	K		x		
Compare numbers	K	Level 1	Level 2	Level 3	Level 4
6. Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies.	K		x		
7. Compare two numbers between 1 and 10 presented as written numerals.	K	x	x		
Operations and Algebraic Thinking	K				

Standard	Grade	Level 1	Level 2	Level 3	Level 4
Understand addition as putting together and adding to, and understand subtraction as taking apart and taking from.	K	Level 1	Level 2	Level 3	Level 4
1. Represent addition and subtraction with objects, fingers, mental images, drawings , sounds (e.g., claps), acting out situations, verbal explanations, expressions, or equations.	K		x		
2. Solve addition and subtraction word problems, and add and subtract within 10, e.g., by using objects or drawings to represent the problem.	K		x		
3. Decompose numbers less than or equal to 10 into pairs in more than one way, e.g., by using objects or drawings, and record each decomposition by a drawing or equation (e.g., 5 = 2 + 3 and 5 = 4 + 1).	K		x	x	
4. For any number from 1 to 9, find the number that makes 10 when added to the given number, e.g., by using objects or drawings, and record the answer with a drawing or equation.	K		x		
5. Fluently add and subtract within 5.	K	x			
Number and Operations in Base Ten	K				
Work with numbers 11–19 to gain foundations for place value.	K	Level 1	Level 2	Level 3	Level 4
1. Compose and decompose numbers from 11 to 19 into ten ones and some further ones, e.g., by using objects or drawings, and record each composition or decomposition by a drawing or equation (e.g., 18 = 10 + 8); understand that these numbers are composed of ten ones and one, two, three, four, five, six, seven, eight, or nine ones.	K		x		
Measurement and Data	K				
Describe and compare measurable attributes.	K	Level 1	Level 2	Level 3	Level 4
1. Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.	K		x		

Standard	Grade	Level 1	Level 2	Level 3	Level 4
2. Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference. For example, directly compare the heights of two children and describe one child as taller/shorter.	K		x		
Classify objects and count the number of objects in each category.	K	Level 1	Level 2	Level 3	Level 4
3. Classify objects into given categories; count the numbers of objects in each category and sort the categories by count.	K	x	x		
Geometry	K				
Identify and describe shapes (squares, circles, triangles, rectangles, hexagons, cubes, cones, cylinders, and spheres).	K	Level 1	Level 2	Level 3	Level 4
1. Describe objects in the environment using names of shapes, and describe the relative positions of these objects using terms such as above, below, beside, in front of, behind, and next to.	K	x	x		
2. Correctly name shapes regardless of their orientations or overall size.	K	x			
3. Identify shapes as two-dimensional (lying in a plane, "flat") or three-dimensional ("solid").	K	x			
Analyze, compare, create, and compose shapes.	K	Level 1	Level 2	Level 3	Level 4
4. Analyze and compare two- and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts (e.g., number of sides and vertices/"corners") and other attributes (e.g., having sides of equal length).	K		x	x	
5. Model shapes in the world by building shapes from components (e.g., sticks and clay balls) and drawing shapes.	K		x	x	
6. Compose simple shapes to form larger shapes. For example, "Can you join these two triangles with full sides touching to make a rectangle?"	K		x	x	
Operations and Algebraic Thinking	1				
Represent and solve problems involving addition and subtraction.	1	Level 1	Level 2	Level 3	Level 4

Standard	Grade	Level 1	Level 2	Level 3	Level 4
1. Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.	1		x		
2. Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.	1		x		
Understand and apply properties of operations and the relationship between addition and subtraction.	1	Level 1	Level 2	Level 3	Level 4
3. Apply properties of operations as strategies to add and subtract. Examples: If 8 + 3 = 11 is known, then 3 + 8 = 11 is also known. (Commutative property of addition.) To add 2 + 6 + 4, the second two numbers can be added to make a ten, so 2 + 6 + 4 = 2 + 10 = 12. (Associative property of addition.)	1		x		
4. Understand subtraction as an unknown-addend problem. For example, subtract 10 – 8 by finding the number that makes 10 when added to 8.	1		x		
Add and subtract within 20.	1	Level 1	Level 2	Level 3	Level 4
5. Relate counting to addition and subtraction (e.g., by counting on 2 to add 2).	1	x	x		
6. Add and subtract within 20, demonstrating fluency for addition and subtraction within 10. Use strategies such as counting on; making ten (e.g., 8 + 6 = 8 + 2 + 4 = 10 + 4 = 14); decomposing a number leading to a ten (e.g., 13 – 4 = 13 – 3 – 1 = 10 – 1 = 9); using the relationship between addition and subtraction (e.g., knowing that 8 + 4 = 12, one knows 12 – 8 = 4); and creating equivalent but easier or known sums (e.g., adding 6 + 7 by creating the known equivalent 6 + 6 + 1 = 12 + 1 = 13).	1	x	x		
Work with addition and subtraction equations.	1	Level 1	Level 2	Level 3	Level 4

Standard	Grade	Level 1	Level 2	Level 3	Level 4
7. Understand the meaning of the equal sign, and determine if equations involving addition and subtraction are true or false. For example, which of the following equations are true and which are false? 6 = 6, 7 = 8 – 1, 5 + 2 = 2 + 5, 4 + 1 = 5 + 2.	1			x	
Determine the unknown whole number in an addition or subtraction equation relating three whole numbers. For example, determine the unknown number that makes the equation true in each of the equations 8 + ? = 11, 5 = ☐ – 3, 6 + 6 = ☐.	1		x		
Number and Operations in Base Ten	1				
Extend the counting sequence.	1	Level 1	Level 2	Level 3	Level 4
1. Count to 120, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral.	1	x	x		
Understand place value.	1	Level 1	Level 2	Level 3	Level 4
2. Understand that the two digits of a two-digit number represent amounts of tens and ones. Understand the following as special cases:	1		x		
a. 10 can be thought of as a bundle of ten ones — called a "ten."	1				
b. The numbers from 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.	1				
c. The numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones).	1				
3. Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols >, =, and <.	1		x		
Use place value understanding and properties of operations to add and subtract.	1	Level 1	Level 2	Level 3	Level 4

Standard	Grade	Level 1	Level 2	Level 3	Level 4
4. Add within 100, including adding a two-digit number and a one-digit number, and adding a two-digit number and a multiple of 10, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used. Understand that in adding two-digit numbers, one adds tens and tens, ones and ones; and sometimes it is necessary to compose a ten.	1	x	x	x	
5. Given a two-digit number, mentally find 10 more or 10 less than the number, without having to count; explain the reasoning used.	1		x	x	
6. Subtract multiples of 10 in the range 10-90 from multiples of 10 in the range 10-90 (positive or zero differences), using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.	1		x	x	
Measurement and Data	1				
Measure lengths indirectly and by iterating length units.	1	Level 1	Level 2	Level 3	Level 4
1. Order three objects by length; compare the lengths of two objects indirectly by using a third object.	1		x	x	
2. Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps. Limit to contexts where the object being measured is spanned by a whole number of length units with no gaps or overlaps.	1	x	x		
Tell and write time.	1	Level 1	Level 2	Level 3	Level 4
3. Tell and write time in hours and half-hours using analog and digital clocks.	1	x			
Represent and interpret data.	1	Level 1	Level 2	Level 3	Level 4

Standard	Grade	Level 1	Level 2	Level 3	Level 4
4. Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.	1		x	x	
Geometry	1				
Reason with shapes and their attributes.	1	Level 1	Level 2	Level 3	Level 4
1. Distinguish between defining attributes (e.g., triangles are closed and three-sided) versus non-defining attributes (e.g., color, orientation, overall size); build and draw shapes to possess defining attributes.	1		x		
2. Compose two-dimensional shapes (rectangles, squares, trapezoids, triangles, half-circles, and quarter-circles) or three-dimensional shapes (cubes, right rectangular prisms, right circular cones, and right circular cylinders) to create a composite shape, and compose new shapes from the composite shape.	1		x	x	
3. Partition circles and rectangles into two and four equal shares, describe the shares using the words halves, fourths, and quarters, and use the phrases half of, fourth of, and quarter of. Describe the whole as two of, or four of the shares. Understand for these examples that decomposing into more equal shares creates smaller shares.	1	x	x		
Operations and Algebraic Thinking	2				
Represent and solve problems involving addition and subtraction.	2	Level 1	Level 2	Level 3	Level 4
1. Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.	2		x		
Add and subtract within 20.	2	Level 1	Level 2	Level 3	Level 4
2. Fluently add and subtract within 20 using mental strategies. By end of Grade 2, know from memory all sums of two one-digit numbers.	2	x			
Work with equal groups of objects to gain foundations for multiplication.	2	Level 1	Level 2	Level 3	Level 4

Standard	Grade	Level 1	Level 2	Level 3	Level 4
3. Determine whether a group of objects (up to 20) has an odd or even number of members, e.g., by pairing objects or counting them by 2s; write an equation to express an even number as a sum of two equal addends.	2		x		
4. Use addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express the total as a sum of equal addends.	2		x		
Number and Operations in Base Ten	2				
Understand place value.	2	Level 1	Level 2	Level 3	Level 4
1. Understand that the three digits of a three-digit number represent amounts of hundreds, tens, and ones; e.g., 706 equals 7 hundreds, 0 tens, and 6 ones. Understand the following as special cases:	2		x		
a. 100 can be thought of as a bundle of ten tens — called a "hundred."	2				
b. The numbers 100, 200, 300, 400, 500, 600, 700, 800, 900 refer to one, two, three, four, five, six, seven, eight, or nine hundreds (and 0 tens and 0 ones).	2				
2. Count within 1000; skip-count by 5s, 10s, and 100s.	2	x			
3. Read and write numbers to 1000 using base-ten numerals, number names, and expanded form.	2	x	x		
4. Compare two three-digit numbers based on meanings of the hundreds, tens, and ones digits, using >, =, and < symbols to record the results of comparisons.	2		x		
Use place value understanding and properties of operations to add and subtract.	2	Level 1	Level 2	Level 3	Level 4
5. Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.	2	x	x		
6. Add up to four two-digit numbers using strategies based on place value and properties of operations.	2		x		

Standard	Grade	Level 1	Level 2	Level 3	Level 4
7. Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method. Understand that in adding or subtracting three-digit numbers, one adds or subtracts hundreds and hundreds, tens and tens, ones and ones; and sometimes it is necessary to compose or decompose tens or hundreds.	2		x		
8. Mentally add 10 or 100 to a given number 100–900, and mentally subtract 10 or 100 from a given number 100–900.	2		x		
9. Explain why addition and subtraction strategies work, using place value and the properties of operations.	2			x	
Measurement and Data	2				
Measure and estimate lengths in standard units.	2	Level 1	Level 2	Level 3	Level 4
1. Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes.	2	x			
2. Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen.	2		x	x	
3. Estimate lengths using units of inches, feet, centimeters, and meters.	2		x		
4. Measure to determine how much longer one object is than another, expressing the length difference in terms of a standard length unit.	2	x	x		
Relate addition and subtraction to length.	2	Level 1	Level 2	Level 3	Level 4
5. Use addition and subtraction within 100 to solve word problems involving lengths that are given in the same units, e.g., by using drawings (such as drawings of rulers) and equations with a symbol for the unknown number to represent the problem.	2		x		

Standard	Grade	Level 1	Level 2	Level 3	Level 4
6. Represent whole numbers as lengths from 0 on a number line diagram with equally spaced points corresponding to the numbers 0, 1, 2, ..., and represent whole-number sums and differences within 100 on a number line diagram.	2	x	x		
Work with time and money.	2	Level 1	Level 2	Level 3	Level 4
7. Tell and write time from analog and digital clocks to the nearest five minutes, using a.m. and p.m.	2	x			
IA.1.Describe the relationship among standard units of time: minutes, hours, days, weeks, months and years.	2		x	x	
8. Solve word problems involving dollar bills, quarters, dimes, nickels, and pennies, using $ and ¢ symbols appropriately. Example: If you have 2 dimes and 3 pennies, how many cents do you have?	2		x		
Represent and interpret data.	2	Level 1	Level 2	Level 3	Level 4
9. Generate measurement data by measuring lengths of several objects to the nearest whole unit, or by making repeated measurements of the same object. Show the measurements by making a line plot, where the horizontal scale is marked off in whole-number units.	2		x		
IA.2. Use interviews, surveys, and observations to collect data that answer questions about students' interests and/or their environment.	2		x	x	
10. Draw a picture graph and a bar graph (with single-unit scale) to represent a data set with up to four categories. Solve simple put-together, take-apart, and compare problems using information presented in a bar graph.	2		x		
Geometry	2				
Reason with shapes and their attributes.	2	Level 1	Level 2	Level 3	Level 4
1. Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces. Identify triangles, quadrilaterals, pentagons, hexagons, and cubes.	2	x	x		

Standard	Grade	Level 1	Level 2	Level 3	Level 4
2. Partition a rectangle into rows and columns of same-size squares and count to find the total number of them.	2		x		
3. Partition circles and rectangles into two, three, or four equal shares, describe the shares using the words halves, thirds, half of, a third of, etc., and describe the whole as two halves, three thirds, four fourths. Recognize that equal shares of identical wholes need not have the same shape.	2		x	x	
Quantities★	9-12				
Reason quantitatively and use units to solve problems.	9-12				
(IA) Understand and apply the mathematics of voting.	9-12	Level 1	Level 2	Level 3	Level 4
IA.3.Understand, analyze, apply, and evaluate some common voting and analysis methods in addition to majority and plurality, such as runoff, approval, the so-called instant-runoff voting (IRV) method, the Borda method and the Condorcet method.	9-12	x	x	x	
(IA) Understand and apply some basic mathematics of information processing and the Internet.	9-12	Level 1	Level 2	Level 3	Level 4
IA.4.(+) Describe the role of mathematics in information processing, particularly with respect to the Internet.	9-12	x			
IA.5.(+) Understand and apply elementary set theory and logic as used in simple Internet searches.	9-12	x	x		
IA. 6(+) Understand and apply basic number theory, including modular arithmetic, for example, as used in keeping information secure through public-key cryptography.	9-12	x	x		
Geometric Measurement and Dimension	9-12				
Visualize relationships between two-dimensional and three-dimensional objects	9-12	Level 1	Level 2	Level 3	Level 4
IA.7.Plot points in three-dimensions.	9-12	x			
Modeling with Geometry	9-12				
(IA) Use diagrams consisting of vertices and edges (vertex-edge graphs) to model and solve problems related to networks.	9-12	Level 1	Level 2	Level 3	Level 4

Standard	Grade	Level 1	Level 2	Level 3	Level 4
IA.8.(*) Understand, analyze, evaluate, and apply vertex-edge graphs to model and solve problems related to paths, circuits, networks, and relationships among a finite number of elements, in real-world and abstract settings.	9-12		x	x	
IA.9.(*) Model and solve problems using at least two of the following fundamental graph topics and models: Euler paths and circuits, Hamilton paths and circuits, the traveling salesman problem (TSP), minimum spanning trees, critical paths, vertex coloring.	9-12		x	x	
IA.10.(*) Compare and contrast vertex-edge graph topics and models in terms of properties, algorithms, optimization, and types of problems that can be solved	9-12		x	x	