The Critical Concepts

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English Language Arts, Mathematics, and Science

OUR MISSION
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Introduction

In 1999, Robert Marzano and John Kendall led a team of researchers at Mid-Continent Research for Education and Learning (McREL) to estimate how much time would be required to teach the 200 academic standards and 3,093 benchmarks in the McREL standards database. The standards and benchmarks were compiled from national and state standards documents and covered fourteen different subject areas. Marzano and Kendall's team surveyed 350 practicing teachers, asking each one to "estimate the amount of time (rounded to the nearest hour) it would take to 'adequately address' the content in a representative sample of benchmarks from the database" (Marzano & Kendall, 1999, p. 102). Based on the evidence they collected, they concluded that "it would take 15,465 hours to cover all 3,093 benchmarks" (p. 104).

To accompany their estimate of the time required to teach all of the benchmarks, Marzano and Kendall (1999) estimated how much instructional time is available to teachers across the K–12 educational interval. They concluded that, using the most optimistic scenarios, 9,042 hours might be available for instruction during a students' career in the United States K–12 education system. Clearly, trying to teach 15,000 hours of content in 9,000 hours of instructional time is a frustrating predicament.

The creation of the Common Core State Standards (CCSS) and the Next Generation Science Standards (NGSS) presented an opportunity to alleviate this issue. However, multiple analyses (for example, Marzano & Yanoski, 2015; Marzano, Yanoski, Hoegh, & Simms, 2013; Porter, McMaken, Hwang, & Yang, 2011) have revealed that the updated standards documents still articulate more content than is practical to teach in the instructional time available. Many teachers recognize this dilemma and must therefore make several unenviable decisions: Do I try to cover all the content in a cursory manner? Do I select specific aspects of the content and teach those well, while deemphasizing (or ignoring) other aspects? How do I know which aspects are most important? Problems such as the following often arise when teachers must make these difficult decisions.

- **Teachers who attempt to cover all the content are overwhelmed.** This might mean that they do not have time to clearly articulate appropriate learning goals, design rigorous instructional activities, or closely assess and track students' learning.
- **Teachers who select specific aspects of the content to focus on are influenced by inappropriate guidelines.** This might mean that a teacher prioritizes only that content which appears on a standardized test students are required to take at the end of the year.
- **Teachers who teach the same courses prioritize different aspects of the content.** This might mean that the content a student learns in a class is dependent on the teacher to whom he or she is assigned.

To address these problems, a team of analysts at Marzano Research sought to identify—as objectively as possible—a focused set of content for each K–12 grade level in English language arts (ELA), mathematics, and science. Our analysis:

- Drew from a wide range of sources and standards documents to ensure that all available content was considered and ranked

- Was informed by blueprint data from standardized tests (such as the Partnership for Readiness in College and Careers [PARCC] and Smarter Balanced Assessment Consortium [SBAC] summative assessments) to ensure that content critical to students' success on those assessments was included
- Used an objective process to identify individual content elements and group them into measurement topics

To provide evidence for review, we preserved all of our working files and papers and attached metadata to every content element; our goal was to be able to explain why any element was included or not included in our set of Critical Concepts.

This report describes the multi-phase process we used to define and articulate the Critical Concepts. The descriptions of phases 1 through 5 explain how we identified measurement topics in the areas of ELA, mathematics, and science (see appendices A, B, and C on pages 30–40 for lists of these measurement topics). The descriptions of phases 6, 7, and 8 explain how we created proficiency scales, or learning progressions, for each of the measurement topics. This report also articulates guidelines that purchasers of the Critical Concepts proficiency scales can use to validate and customize the scales for their local standards and students.

This is the final version of this report as it pertains to Marzano Research's Critical Concepts work in ELA, math, and science (replacing draft versions 1.0 and 2.0 published in August 2015 and January 2016, respectively). Future work and reports will address Critical Concepts work in at least two additional areas: social studies and cognitive skills.

Phase 1

To begin our analysis, we collected standards from three sources:

- Grades K–8: *Making Standards Useful in the Classroom* (Marzano & Haystead, 2008)
- Grades K–12: *Common Core State Standards* (National Governors Association for Best Practices & Council of Chief State School Officers, 2010a, 2010b)
- Grades K–12: *Next Generation Science Standards* (NGSS Lead States, 2013)

Making Standards Useful in the Classroom presented an analysis of all available standards documents in 2008 (including the 200 standards and 3,093 benchmarks in the McREL standards database). In that book, Marzano and Haystead (2008) analyzed and condensed the standards and benchmarks into proficiency scales (that is, learning progressions) for grades K–8 in the content areas of language arts, mathematics, science, social studies, and life skills. We drew from this source to ensure that we included all standards documents published prior to the CCSS and NGSS.

Next, we analyzed the test blueprints for the PARCC and SBAC summative assessments to determine which content was included on those assessments and its relative importance to students' success. We rated each standard as high (H) importance, medium (M) importance, or low (L) importance for each test. *It is important to note that this data informed our analysis but did not drive it.* Throughout the process, we revisited which content was important for students' success on the tests, and sought to include it without focusing on it exclusively.

Table 1 shows the grade levels and content areas of the standards included in our analysis, the source(s) for each grade level and content area, and an indication of whether we were able to assign importance ratings to standards in those areas for the PARCC and SBAC summative assessments.

Table 1. Sources and Available Rating Data

Level	Source	PARCC Ratings Available	SBAC Ratings Available
Kindergarten ELA	MSU, CCSS	no	no
Kindergarten Math	MSU, CCSS	no	no
Kindergarten Science	MSU, NGSS	no	no
Grade 1 ELA	MSU, CCSS	no	no
Grade 1 Math	MSU, CCSS	no	no
Grade 1 Science	MSU, NGSS	no	no
Grade 2 ELA	MSU, CCSS	no	no
Grade 2 Math	MSU, CCSS	no	no
Grade 2 Science	MSU, NGSS	no	no
Grade 3 ELA	MSU, CCSS	yes	yes
Grade 3 Math	MSU, CCSS	yes	yes
Grade 3 Science	MSU, NGSS	no	no
Grade 4 ELA	MSU, CCSS	yes	yes
Grade 4 Math	MSU, CCSS	yes	yes
Grade 4 Science	MSU, NGSS	no	no
Grade 5 ELA	MSU, CCSS	yes	yes
Grade 5 Math	MSU, CCSS	yes	yes
Grade 5 Science	MSU, NGSS	no	no
Grade 6 ELA	MSU, CCSS	yes	yes
Grade 6 Math	MSU, CCSS	yes	yes
Grade 7 ELA	MSU, CCSS	yes	yes
Grade 7 Math	MSU, CCSS	yes	yes
Grade 8 ELA	MSU, CCSS	yes	yes
Grade 8 Math	MSU, CCSS	yes	yes
Middle School Science	MSU, NGSS	no	no
Grades 9–10 ELA	CCSS	yes	no
Grades 11–12 ELA	CCSS	yes	yes
High School Math	CCSS	yes	yes
High School Science	NGSS	no	no

Key: MSU = *Making Standards Useful in the Classroom;* CCSS = *Common Core State Standards;* NGSS = *Next Generation Science Standards*

As shown in table 1, summative assessment data was available for grades 3–8 in ELA and mathematics. At the high school level, PARCC summative assessment data was available for grades 9–12 in ELA and mathematics, and SBAC summative assessment data was available for grade 11 in ELA and grades 9–12 in mathematics.

Next, we divided each standard into its related vocabulary terms and component parts. For example, consider the following standard from the CCSS for grade 8 ELA.

> Support claim(s) with logical reasoning and relevant evidence, using accurate, credible sources and demonstrating an understanding of the topic or text. (CCSS.ELA-LITERACY.W.8.1b)

There are a number of key vocabulary terms in this standard, including *support*, *claim*, *logical*, *reasoning*, *relevant*, *evidence*, *accurate*, *credible*, and *source.* There are also a number of elements of knowledge or skill, including:

- Support claims with logical reasoning
- Support claims with relevant evidence
- Support claims using accurate, credible sources
- Demonstrate an understanding of the topic or text

Readers will notice that the preceding list of knowledge and skills were identified by linguistically separating the individual phrases and clauses from the standard. All of the original wording and language from the standard have been retained; each element has simply been separated from the others. We used this approach to identify discrete elements of knowledge or skill in the standards because it was extremely objective. Individual raters obtained the same results, regardless of their biases, backgrounds, or levels of expertise with the content. Table 2 illustrates the result of the initial phase of our analysis for the previously referenced standard.

Table 2. Data for CCSS.ELA-LITERACY.W.8.1b After Phase 1

Standard	Support claim(s) with logical reasoning and relevant evidence, using accurate, credible sources and demonstrating an understanding of the topic or text. (CCSS.ELA-LITERACY.W.8.1b)
Importance rating on PARCC summative	H
Importance rating on SBAC summative	H
Vocabulary	*support*
	claim
	logical
	reasoning
	relevant
	evidence
	accurate
	credible
	source
Component Parts	support claims with logical reasoning
	support claims with relevant evidence
	support claims using accurate, credible sources
	demonstrate an understanding of the topic or text

In our working files, each vocabulary term and component part was linked to all its associated metadata (that is, standard, importance ratings, strand, source, and so on).

Phase 2

We began phase 2 by moving all vocabulary terms to a separate document. Then, we sorted the component parts into categories by grouping similar component parts together. In some cases, we used keywords to determine that two component parts were similar. In other cases, we determined that one component part referred to a subskill that was part of a larger skill referenced in another component part. There were a few cases where two component parts were grouped together because the skills articulated in each were clearly best addressed together.

Once all of the component parts within a content area for one grade level had been sorted, we named each category (to facilitate reference to groupings later in the process) and used Microsoft Excel to order the list of components by four nested criteria:

1. Category name (alphabetical)
2. Importance rating on PARCC summative assessment (H, M, L)
3. Importance rating on SBAC summative assessment (H, M, L)
4. Component part (alphabetical)

Sorting the component parts in this way allowed us to assign each category a summative assessment importance rating based on the component parts within it.

- If a category contained component parts from standards that were rated H for both the PARCC and SBAC summative assessments, we assigned that category a rating of 1.
- If a category contained component parts from standards that were rated H for either the PARCC or the SBAC summative assessments (but not both), or if a category contained component parts that were rated M or L on both the PARCC and SBAC summative assessments, we assigned that category a rating of 2.
- If a category contained component parts from standards that were rated M or L on either the PARCC or SBAC summative assessments (but not both), or if a category contained component parts from standards that were not addressed by either the PARCC or SBAC summative assessments, we assigned that category a rating of 3.

Readers should keep in mind that these ratings were not used to make final decisions about which standards were or were not essential. Instead, we used them to inform our decisions and remain aware of the knowledge and skills that students would need to be successful on summative assessments, so as not to inappropriately exclude such content. For subjects or grade levels without summative assessment ratings (e.g., science), no category ratings were assigned.

The final step of phase 2 involved using Excel to order the list once again, but this time according to five nested criteria:

1. Category rating (numerical)
2. Category name (alphabetical)

3. Importance rating on PARCC summative assessment (H, M, L)
4. Importance rating on SBAC summative assessment (H, M, L)
5. Component part (alphabetical)

Table 3 illustrates the result of the second phase of our analysis for the category of Examining Claims and Evidence for grade 8 ELA.

Table 3. Examining Claims and Evidence Category After Phase 2

Component Part	Source Standard	PARCC Rating	SBAC Rating
assess whether the evidence is relevant in an argument	CCSS.ELA-LITERACY.RI.8.8	H	H
assess whether the evidence is sufficient in an argument	CCSS.ELA-LITERACY.RI.8.8	H	H
assess whether the evidence is relevant in a specific claim	CCSS.ELA-LITERACY.RI.8.8	H	H
assess whether the evidence is sufficient in a specific claim	CCSS.ELA-LITERACY.RI.8.8	H	H
recognize when irrelevant evidence is introduced	CCSS.ELA-LITERACY.RI.8.8	H	H
support claim(s) with logical reasoning	CCSS.ELA-LITERACY.W.8.1.B	H	H
support claim(s) with relevant evidence	CCSS.ELA-LITERACY.W.8.1.B	H	H
acknowledge the claim(s) from alternate claims	CCSS.ELA-LITERACY.W.8.1.A	H	M
acknowledge the claim(s) from opposing claims	CCSS.ELA-LITERACY.W.8.1.A	H	M
distinguish the claim(s) from alternate claims	CCSS.ELA-LITERACY.W.8.1.A	H	M
distinguish the claim(s) from opposing claims	CCSS.ELA-LITERACY.W.8.1.A	H	M
write arguments to support claims with clear reasons	CCSS.ELA-LITERACY.W.8.1	H	M
write arguments to support claims with relevant evidence	CCSS.ELA-LITERACY.W.8.1	H	M
evaluate the relevance of the evidence for a speaker's argument	CCSS.ELA-LITERACY.SL.8.3		L
evaluate the sufficiency of the evidence for a speaker's argument	CCSS.ELA-LITERACY.SL.8.3		L
identify when irrelevant evidence is introduced in a speaker's argument	CCSS.ELA-LITERACY.SL.8.3		L
evaluate the relevance of the evidence for a speaker's specific claims	CCSS.ELA-LITERACY.SL.8.3		L
evaluate the sufficiency of the evidence for a speaker's specific claims	CCSS.ELA-LITERACY.SL.8.3		L
identify when irrelevant evidence is introduced in a speaker's specific claims	CCSS.ELA-LITERACY.SL.8.3		L
acknowledge new information expressed by others	CCSS.ELA-LITERACY.SL.8.1.D		
when warranted, justify their own views in light of the evidence presented by others	CCSS.ELA-LITERACY.SL.8.1.D		
when warranted, qualify their own views in light of the evidence presented by others	CCSS.ELA-LITERACY.SL.8.1.D		

As shown in table 3, the category of Examining Claims and Evidence involved component parts from a number of different standards, and the category's importance rating for PARCC and SBAC summative assessments was 1, because it contained component parts from standards of high importance on both tests.

Phase 3

The third phase of our analysis resembled the second phase in that it involved sorting similar component parts into groups and labeling those groups. However, phase 3 differed from phase 2 in that we focused on one category at a time. For each category, we examined the component parts within that category and grouped similar component parts together, creating subgroups within each category. For example, within the category of Examining Claims and Evidence, we grouped the component parts shown in table 4 together because they all related to evaluating the relevance of evidence for a claim.

Table 4. Component Parts Related to Evaluating the Relevance of Evidence for a Claim

Component Part	Source Standard	PARCC Rating	SBAC Rating
assess whether the evidence is relevant in an argument	CCSS.ELA-LITERACY.RI.8.8	H	H
assess whether the evidence is relevant in a specific claim	CCSS.ELA-LITERACY.RI.8.8	H	H
evaluate the relevance of the evidence for a speaker's argument	CCSS.ELA-LITERACY.SL.8.3		L
evaluate the relevance of the evidence for a speaker's specific claims	CCSS.ELA-LITERACY.SL.8.3		L

In some cases, as we grouped component parts within categories, we realized that specific component parts had been miscategorized during the phase 2 categorization, and would actually fit better in a different category. When that was the case, we labeled the component part as "miscategorized" and moved it to the end of the list. After all component parts in all categories had been grouped, we assigned the miscategorized component parts to more appropriate categories and subgroups.

In other cases, component parts referred to knowledge or skills in ways that were very general. For example, consider the following component part from standard CCSS.ELA-LITERACY.W.8.1b:

> Demonstrate an understanding of the topic or text.

Although this component part articulates an important skill for students to acquire, it is not as specific as other component parts, which more clearly articulate the knowledge and skills requisite to demonstrating an understanding of a topic or text. Such component parts were labeled as "general," collected at the end of the list, and ultimately deleted from our analysis.

Next, we wrote an element for each subgroup; an element is a statement describing one aspect of knowledge or skill. For the subgroup of component parts shown in table 4, we wrote the following element:

> Students will evaluate the relevance of evidence for a claim.

It is instructive to note that most of the narrowing and focusing in the Critical Concepts was the result of summarizing similar component parts with a single element, rather than deleting content. We strove to make each element unidimensional; that is, each element expressed only one aspect of knowledge or skill. If a subgroup contained component parts which could not be summarized by a unidimensional element, the subgroup was split into smaller groups until a unidimensional element could be composed for each one.

Finally, we assigned summative assessment importance ratings to each element, using a process similar to the one used during phase 2:

- If an element contained component parts from standards that were rated H for both the PARCC and SBAC summative assessments, we assigned that element a rating of 1.
- If an element contained component parts from standards that were rated H for either the PARCC or the SBAC summative assessments (but not both), or if an element contained component parts that were rated M or L on both the PARCC and SBAC summative assessments, we assigned that element a rating of 2.
- If an element contained component parts from standards that were rated M or L on either the PARCC or SBAC summative assessments (but not both), or if an element contained component parts from standards that were not addressed by either the PARCC or SBAC summative assessments, we assigned that element a rating of 3.

Thus, each element had two summative assessment importance ratings associated with it: one for the category it was in and one for the element itself.

Phase 4

During phase 4, we sorted the elements into tentative measurement topics. This involved grouping similar elements together and assigning tentative measurement topic titles to each group. We preserved the category and element ratings, listing them before each element. Table 5 lists the tentative measurement topics and elements for grade 8 ELA after phase 4.

Table 5. Tentative Grade 8 ELA Measurement Topics After Phase 4

Audience and Purpose	1—1 Students will plan writing so it consistently addresses audience. 1—1 Students will plan writing so it consistently addresses purpose. 1—1 Students will produce writing that is appropriate to audience. 1—1 Students will produce writing that is appropriate to purpose. 1—1 Students will produce writing that is appropriate to task. 1—1 Students will revise writing so it consistently addresses audience. 1—1 Students will revise writing so it consistently addresses purpose. 1—1 Students will rewrite so writing consistently addresses audience. 1—1 Students will rewrite so writing consistently addresses purpose. 1—1 Students will edit their writing so it consistently addresses audience. 1—1 Students will edit their writing so it consistently addresses purpose. 1—3 Students will demonstrate an understanding of audience. 1—3 Students will demonstrate an understanding of purpose. 3—3 Students will adjust presentation techniques based on audience reactions.
Citations	1—1 Students will avoid plagiarism when citing others. 1—1 Students will follow a standard format for citation when citing others.

Claims, Evidence, and Reasoning	1—1 Students will identify specific claims and the evidence given for them. 1—1 Students will evaluate specific claims and the evidence given for them. 1—1 Students will evaluate the relevance of evidence for a claim. 1—1 Students will evaluate the sufficiency of evidence for a claim. 1—1 Students will identify irrelevant evidence. 1—1 Students will support claims with logical reasoning. 1—1 Students will support claims with relevant evidence. 1—2 Students will support claims with clear reasons. 1—2 Students will differentiate claims from alternate or opposing claims. 1—3 Students will react to textual arguments. 2—2 Students will introduce claims. 2—2 Students will organize evidence and reasons logically. 3—3 Students will present well-reasoned claims in a detailed, supported manner. 3—3 Students will recognize a variety of fallacies in an argument. 3—3 Students will write complex persuasive compositions.
Collaboration	2—2 Students will use technology to interact with others. 3—3 Students will define individual roles in group settings as needed. 3—3 Students will follow rules for collegial discussions. 3—3 Students will follow rules for decision-making in group settings. 3—3 Students will participate in a range of collaborative discussions with a variety of groups. 3—3 Students will track their progress.
Conclusions	2—2 Students will write a conclusion that follows from the content presented. 2—2 Students will write a conclusion that reflects on the content presented. 2—2 Students will write a conclusion that supports the content presented.
Content Selection	2—2 Students will analyze relevant content when writing informative/explanatory texts. 2—2 Students will select relevant content when writing informative/explanatory texts. 2—2 Students will develop topics with relevant content.
Conventions	2—2 Students will correct inappropriate shifts in verb usage. 2—2 Students will demonstrate command of the conventions of English capitalization when writing. 2—2 Students will demonstrate command of the conventions of standard English punctuation when writing. 2—2 Students will demonstrate command of the conventions of standard English spelling when writing. 2—2 Students will explain the function of verbals. 2—2 Students will form verbs in a variety of moods. 2—2 Students will use a variety of punctuation marks to indicate a pause. 2—2 Students will write verbs in the active voice to achieve particular effects. 2—2 Students will write verbs in the passive voice to achieve particular effects. 2—3 Students will correctly use standard English mechanics. 2—3 Students will demonstrate fluid use of all verb tense forms. 2—3 Students will proofread for tense use and purposeful tense shifts in their writing. 2—3 Students will use spelling conventions to help them determine the meaning of words.
Drafting	2—2 Students will use technology to produce writing. 2—2 Students will write routinely over extended time frames (time for research, reflection, and revision). 2—2 Students will write routinely over shorter time frames (a single sitting or a day or two). 3—3 Students will check for clarity while drafting writing.
Information Evaluation	1—1 Students will assess the accuracy of presented information. 1—1 Students will assess the credibility of presented information. 1—3 Students will analyze the logic of an extended oral presentation. 1—3 Students will respond to information presented by others. 3—3 Students will pose questions informed by others' responses.
Introductions	2—2 Students will preview what is to follow when introducing a topic.

(continued on next page)

Main Idea and Theme	2—2 Students will describe how a central idea develops over the course of a text. 2—2 Students will describe how a theme develops over the course of a text. 2—2 Students will describe a central idea's relationship to elements of the text. 2—2 Students will describe a theme's relationship to elements of the text. 2—3 Students will compare and contrast themes that occur across multiple works from a specific time period.
Meaning and Language	1—1 Students will use domain-specific vocabulary when writing about a topic. 1—1 Students will use precise language to develop writing. 1—2 Students will describe the impact of specific word choices. 1—2 Students will distinguish between connotative and denotative meanings. 1—2 Students will interpret the meaning of figurative language. 1—2 Students will use word relationships to better understand words in context. 1—3 Students will explain how current events influence the development of language. 2—2 Students will acquire new academic vocabulary. 2—2 Students will consult reference materials to determine a word's precise meaning. 2—2 Students will use common Greek roots and affixes to help them determine the meaning of words. 2—2 Students will use common Latin roots and affixes to help them determine the meaning of words. 2—2 Students will use context to help them determine the meaning of words and phrases. 2—2 Students will use reference materials to find a word's part of speech and pronunciation. 2—3 Students will describe the literal meaning of figurative language.
Multimedia and Formatting	2—2 Students will integrate multimedia into projects. 2—2 Students will integrate visual displays into projects. 2—2 Students will use formatting to aid comprehension.
Narrative Development	2—2 Students will examine how particular lines of dialogue in a text affect the development of a story or character. 2—2 Students will examine how incidents in a text affect the development of a story or character. 2—2 Students will write narratives about imagined events or experiences. 2—2 Students will establish context. 2—2 Students will introduce characters. 2—2 Students will use description to develop content. 2—2 Students will use dialogue to develop content. 2—2 Students will write narratives about real events or experiences. 2—2 Students will use pacing to develop content. 2—2 Students will use reflection to develop content. 2—2 Students will use relevant descriptive details to develop writing. 2—2 Students will use sensory language to develop writing. 3—3 Students will vary sentence forms in their writing.
Organization and Structure	1—3 Students will organize information by generating multi-level outlines. 2—2 Students will analyze the structure of texts. 2—2 Students will compare and contrast the structure of two texts. 2—2 Students will describe the role of specific paragraphs and sentences in the development of a text. 2—2 Students will explain how a text makes connections among content. 2—2 Students will explain how a text makes distinctions among content. 2—2 Students will effectively organize content in informative/explanatory texts. 2—2 Students will organize elements of the text into broader categories. 2—2 Students will use a variety of transitions to convey progression. 2—2 Students will use a variety of transitions to create cohesion in a text. 2—2 Students will use technology to present relationships. 2—2 Students will use transitions to clarify the relationships among content. 2—3 Students will identify multiple story lines in a complex plot. 3—3 Students will identify causal relationships in grade-appropriate texts. 3—3 Students will pose questions that connect the ideas of several speakers.

Point of View	1—1 Students will determine point of view. 1—1 Students will determine purpose. 1—3 Students will revise writing for appropriate point of view. 2—2 Students will describe how differences in points of view can create humor in a text. 2—2 Students will describe how differences in points of view can create suspense in a text. 2—2 Students will establish a point of view. 3—3 Students will effectively employ voice in their writing. 3—3 Students will proofread for point of view while drafting writing.
Presentation	3—3 Students will give presentations including extended persuasive presentations. 3—3 Students will use appropriate volume, pronunciation, and eye contact while presenting.
Research	1—2 Students will conduct short research projects to answer a question. 1—2 Students will generate related questions while conducting a short research project. 2—3 Students will present well-reasoned findings in a detailed, supported manner.
Revision	1—3 Students will revise writing for clarity. 1—3 Students will revise writing for consistent voice. 1—3 Students will use revision tools while revising.
Style	2—2 Students will maintain the use of a formal style. 2—3 Students will use formal English when appropriate. 3—3 Students will compose formal letters.
Summarizing	2—2 Students will provide an objective summary of a text. 3—3 Students will identify problems that will not be solved in texts.
Text Analysis	3—3 Students will examine persuasive techniques for validity. 3—3 Students will examine significant literary devices in an analysis of a work. 3—3 Students will examine the importance of setting in an analysis of a work. 3—3 Students will examine the relationships among various forms of poetry in an analysis of a genre.
Text Comparisons	2—2 Students will describe how a live or filmed production departs from or remains faithful to the source text. 2—2 Students will describe how a modern work of fiction draws on character types from classic texts. 2—2 Students will describe how a modern work of fiction draws on patterns of events from classic texts. 2—2 Students will describe how a modern work of fiction draws on themes from classic texts. 2—2 Students will evaluate the production choices in a live or filmed interpretation of a text. 2—2 Students will evaluate the advantages and disadvantages of using different mediums to convey ideas.
Textual Evidence	1—1 Students will cite textual evidence that supports an analysis of the text. 1—1 Students will gather supporting evidence from texts. 1—1 Students will identify conflicting information in texts. 1—1 Students will examine how texts address conflicting information. 1—1 Students will effectively use search terms to gather relevant information from multiple sources. 1—2 Students will draw on multiple sources to answer a question. 1—3 Students will refer to textual evidence in discussions. 1—3 Students will use effective interviewing techniques to gather information. 1—3 Students will ask questions that require a speaker to reconcile contradictory or inconsistent information on a topic. 3—3 Students will come to discussions prepared, having read and researched materials.

Phase 5

During phase 5, two raters with curriculum experience reviewed the lists of tentative measurement topics and elements. They classified each element as:

- Content that is so general that it is implicit in other elements;
- Content that should be reinforced during instruction but not formally assessed; or
- Content that should be taught and formally assessed.

Content that was so general as to be implicit in other elements was deleted. Content that should be reinforced during instruction but not formally assessed was listed separately at the end of each set of measurement topics for a grade level and content area. Finally, content that should be taught and formally assessed was either kept in its current measurement topic or moved to a different one if the rater determined that to be most appropriate. In some cases, elements were combined if they referred to the same dimension of knowledge or skills. Category and element importance ratings, when available, informed these judgments but did not drive them.

Raters also examined the tentative measurement topic titles. In some cases, they retained the measurement topic title; in others they made slight revisions to the measurement topic title; and for the remainder, they created new measurement topic titles. At the end of phase 5, the category and element ratings were replaced by bullets and the words "students will" were removed so that each bullet began with a verb. The result of phase 5 for grade 8 ELA is shown in table 6.

Table 6. Draft Measurement Topics and Elements for Grade 8 ELA After Phase 5

Analyzing Text Organization and Structure
- Identify relationships among content in a text
- Describe the role of specific paragraphs and sentences in the development of a text

Analyzing Ideas and Themes
- Describe the main idea or theme in a text
- Describe how a main or central idea or theme develops over the course of a text
- Describe a main or central idea's or theme's relationship to other elements of the text

Analyzing Claims, Evidence, and Reasoning
- Compare arguments to alternate or opposing arguments
- Evaluate the relevance, sufficiency, credibility, and accuracy of evidence for a specific claim
- Identify errors in reasoning (i.e., logical errors, fallacies) in an argument

Analyzing Narratives
- Describe how events and dialogue in a text affect the development of the story
- Describe how events and dialogue in a text reveal the development of character

Analyzing Point of View and Purpose
- Describe the point of view in a text
- Describe the purpose of a text
- Describe how differences in the point of view of the reader and the characters in a text can create dramatic irony

Comparing Texts
- Describe the faithfulness of a live or filmed production to a source text
- Describe how a work of fiction draws on character types, patterns of events, and themes from classic texts
- Compare various media (including genres such as poetry, prose, and drama) by stating the advantages and disadvantages of expressing ideas in each

Analyzing Language
- Determine the denotative meaning of words using reference materials, Greek and Latin roots and affixes, and context
- Interpret the connotative meaning of words and the meaning of figurative language

Generating Text Organization and Structure
- Organize and logically order content into categories
- Generate an introduction that previews what is to follow
- Use transitions to create connections and clarify relationships in a text
- Generate a conclusion that summarizes and logically follows from the information or evidence presented

Generating Claims, Evidence, and Reasoning
• Generate claims and distinguish them from counterclaims
• Support claims with relevant and sufficient evidence as well as logical reasoning
Generating Narratives
• Introduce the conflict, setting (or context), and characters of a story
• Use description (including sensory details), dialogue, and reflection to develop a narrative
Considering Point of View, Purpose, and Audience
• Establish a clear point of view when writing
• Write for a specific purpose
• Write for a specific audience
Revision and Style
• Revise writing for a specific audience and purpose
• Rewrite sentences so that syntax and sentence forms are varied
• Revise writing to maintain a formal style
Appropriate Verb Usage
• Use active and passive verbs to achieve particular effects
• Understand the function of a variety of verb tenses and moods
Using Appropriate Citations
• Use a standard citation format
• Avoid plagiarism
Editing
• Edit writing for proper use of commas, dashes, and ellipses
• Edit writing for capitalization and proper formatting of titles
• Edit writing for spelling errors

The preliminary lists of measurement topics generated during phase 5 were published in draft version 1.0 (August 2015) of this report. During phases 6, 7, and 8, the lists of measurement topics were refined and revised. Draft version 2.0 (January 2016) of this report reported a partially revised list of measurement topics, as the report was published while phases 6 and 7 were in progress. All phases of the project are now complete and this report presents the final lists of Critical Concepts measurement topics for ELA (appendix A; page 30), mathematics (appendix B; page 34), and science (appendix C; page 38).

Phase 6

During phase 6, work papers from previous phases were used to match each element with the standard(s) from which it was drawn. Table 7 (pages 16–19) shows the standards associated with each element for several measurement topics from grade 8 ELA (bold font indicates the part[s] of a standard on which each element is based).

Table 7. Standards Associated With Elements of Selected Measurement Topics for Grade 8 ELA

Analyzing Claims, Evidence, and Reasoning		
• Compare arguments to alternate or opposing arguments	CCSS.ELA-LITERACY.RI.8.8	**Delineate** and evaluate **the argument and specific claims in a text,** assessing whether the reasoning is sound and the evidence is relevant and sufficient; recognize when irrelevant evidence is introduced.
	CCSS.ELA-LITERACY.SL.8.3	**Delineate a speaker's argument and specific claims,** evaluating the soundness of the reasoning and relevance and sufficiency of the evidence and identifying when irrelevant evidence is introduced.
• Evaluate the relevance, sufficiency, credibility, and accuracy of evidence for a specific claim	CCSS.ELA-LITERACY.RI.8.8	Delineate and **evaluate the argument and specific claims in a text, assessing whether** the reasoning is sound and **the evidence is relevant and sufficient; recognize when irrelevant evidence is introduced.**
	CCSS.ELA-LITERACY.W.8.8	Gather relevant information from multiple print and digital sources, using search terms effectively; **assess the credibility and accuracy of each source;** and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
	CCSS.ELA-LITERACY.SL.8.3	Delineate a speaker's argument and specific claims, **evaluating the** soundness of the reasoning and **relevance and sufficiency of the evidence and identifying when irrelevant evidence is introduced.**
	MSU.8. AEOM.3	While participating in grade-appropriate oral communication, the student formulates thoughtful conclusions about the content and delivery **by analyzing the credibility of the speaker** *(e.g., determining credibility on an issue by checking a speaker's bio for degrees, publications, and other information that might indicate adequate knowledge to present opinions about the topic).*
	MSU.8. AEOM.4	While participating in grade-appropriate oral communication, the student formulates thoughtful conclusions about the content and delivery **by checking the accuracy of information presented by the speaker** *(e.g., confirming the accuracy of a speaker's use of statistics to support a claim that appears unlikely to be true).*
	MSU.8.OC.1	While participating in grade-appropriate oral communication, the student demonstrates the ability to listen critically and respond appropriately **by analyzing the logic of an extended oral presentation** *(e.g., analyzing how effectively the speaker supports claims made during a presentation).*

• Identify errors in reasoning (i.e., logical errors, fallacies) in an argument	CCSS.ELA-LITERACY.RI.8.8	Delineate and **evaluate the argument and specific claims in a text, assessing whether the reasoning is sound** and the evidence is relevant and sufficient; recognize when irrelevant evidence is introduced.
	CCSS.ELA-LITERACY.SL.8.3	Delineate a speaker's argument and specific claims, **evaluating the soundness of the reasoning** and relevance and sufficiency of the evidence and identifying when irrelevant evidence is introduced.
	MSU.8. AEOM.1	While participating in grade-appropriate oral communication, the student formulates thoughtful conclusions about the content and delivery **by analyzing the speaker's presentation for less common informal fallacies such as use of faulty reasoning and presence of obstacles to clarity and accuracy** *(e.g., determining when a speaker makes an incorrect assumption and explaining why the assumption is inaccurate).*
	MSU.8. AEOM.2	While participating in grade-appropriate oral communication, the student formulates thoughtful conclusions about the content and delivery **by analyzing the speaker's use of invalid and less common persuasive techniques such as appeals to personality, tradition, and rhetoric** *(e.g., determining when a speaker appeals to tradition and explaining why this type of argument is invalid).*
	MSU.8.RMI.2	While engaged in grade-appropriate reading tasks, the student demonstrates **an ability to identify and react to textual arguments** *(e.g., summarizing the argument presented and explains why he or she was persuaded or not).*
Analyzing Point of View and Purpose		
• Describe the point of view in a text	CCSS.ELA-LITERACY.RI.8.6	**Determine an author's point of view** or purpose **in a text** and analyze how the author acknowledges and responds to conflicting evidence or viewpoints.
	CCSS.ELA-LITERACY.SL.8.2	Analyze the purpose of information presented in diverse media and formats (e.g., visually, quantitatively, orally) and **evaluate the motives (e.g., social, commercial, political) behind its presentation.**
	MSU.8.OC.3	While participating in grade-appropriate oral communication, the student demonstrates the ability to listen critically and respond appropriately **by using the speaker's nonverbal messages to infer speaker's point of view toward the content** *(e.g., analyzing gestures, facial expressions, posture, and other body language to determine a speaker's point of view toward the content in an oral presentation).*

(continued on next page)

Analyzing Point of View and Purpose (continued)		
• Describe the purpose of a text	CCSS.ELA-LITERACY.RI.8.6	**Determine an author's** point of view or **purpose in a text** and analyze how the author acknowledges and responds to conflicting evidence or viewpoints.
	CCSS.ELA-LITERACY.SL.8.2	**Analyze the purpose of information presented in diverse media and formats (e.g., visually, quantitatively, orally)** and evaluate the motives (e.g., social, commercial, political) behind its presentation.
• Describe how differences in the point of view of the reader and the characters in a text can create dramatic irony	CCSS.ELA-LITERACY.RL.8.6	**Analyze how differences in the points of view of the characters and the audience or reader (e.g., created through the use of dramatic irony) create such effects as suspense or humor.**
Generating Claims, Evidence, and Reasoning		
• Generate claims and distinguish them from counterclaims	CCSS.ELA-LITERACY.SL.8.4	**Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details;** use appropriate eye contact, adequate volume, and clear pronunciation.
	CCSS.ELA-LITERACY.W.8.1.A	**Introduce claim(s), acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.**
	MSU.8.F.1	While engaged in grade-appropriate writing tasks, the student demonstrates competence in a variety of formats **by writing complex persuasive compositions** *(e.g., writing persuasive compositions that employ clear claims, backing, warrants, and qualifiers).*
• Support claims with relevant and sufficient evidence as well as logical reasoning	CCSS.ELA-LITERACY.RI.8.1	**Cite the textual evidence that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text.**
	CCSS.ELA-LITERACY.RL.8.1	**Cite the textual evidence that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text.**
	CCSS.ELA-LITERACY.W.8.1	**Write arguments to support claims with clear reasons and relevant evidence.**
	CCSS.ELA-LITERACY.W.8.1.B	**Support claim(s) with logical reasoning and relevant evidence, using accurate, credible sources and demonstrating an understanding of the topic or text.**
	CCSS.ELA-LITERACY.W.8.9	**Draw evidence from literary or informational texts to support analysis, reflection, and research.**

Using Appropriate Citations		
• Use a standard citation format	CCSS.ELA-LITERACY.W.8.8	Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and **following a standard format for citation**.
• Avoid plagiarism	CCSS.ELA-LITERACY.W.8.8	Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and **quote or paraphrase the data and conclusions of others while avoiding plagiarism** and following a standard format for citation.

The purpose of the alignment shown in table 7 was twofold. First, we wanted to ensure that no essential content was overlooked or inadvertently deleted during the first five phases of our analysis. Second, identifying the standards associated with each element prepared us for the next phase by supplying specific examples and links to resources associated with each element.

Phase 7

During phase 7, instructional resources for each element were identified and, using the information in those resources, simpler and more complex content was articulated for each element. The target content (elements), simpler content, and more complex content were then organized into a proficiency scale (Marzano, 2010). The generic form of a proficiency scale is shown in table 8.

Table 8. Generic Form of a Proficiency Scale

4.0	**More complex content**
3.5	In addition to score 3.0 performance, partial success at score 4.0 content
3.0	**Target content**
2.5	No major errors or omissions regarding score 2.0 content, and partial success at score 3.0 content
2.0	**Simpler content**
1.5	Partial success at score 2.0 content, and major errors or omissions regarding score 3.0 content
1.0	With help, partial success at score 2.0 content and score 3.0 content
0.5	With help, partial success at score 2.0 content but not at score 3.0 content
0.0	Even with help, no success

Table 9 (page 20) shows the proficiency scale for the ELA measurement topic of Analyzing Claims, Evidence, and Reasoning at grade 8.

Table 9. Proficiency Scale for Analyzing Claims, Evidence, and Reasoning at Grade 8

4.0	The student will: • Evaluate the argument in a text by deciding if the reasoning is sound, if the claims have sufficient evidence, and if the author appropriately responds to conflicting arguments (for example, examine the argument in Charles Wilson and Eric Schlosser's book *Chew on This: Everything You Don't Want to Know About Fast Food* and determine how well the authors address opposing arguments which claim that fast food restaurants provide affordable and convenient meals).
3.5	In addition to score 3.0 performance, partial success at score 4.0 content
3.0	The student will: **ACER1—Compare arguments to alternate or opposing arguments** (for example, identify similarities and differences between the claims and evidence provided by two articles featured in the *New York Times*' Room for Debate feature "Taking Sports Out of School"). **ACER2—Evaluate the relevance, sufficiency, credibility, and accuracy of evidence for a specific claim** (for example, read Terra Snider's cnn.com article "Let Kids Sleep Later" and explain why the evidence for her claim that school should start later is or is not sufficient and credible). **ACER3—Identify errors in reasoning (i.e., logical errors, fallacies) in an argument** (for example, watch a campaign attack ad and identify how the advertisement employs unsound logic to discredit another candidate).
2.5	No major errors or omissions regarding score 2.0 content, and partial success at score 3.0 content
2.0	**ACER1—**The student will recognize or recall specific vocabulary (for example, *argument*, *backing*, *claim*, *evidence*, *grounds*, *paragraph*, *qualifier*, *reasoning*, *summarize*) and perform basic processes such as: • Describe the parts of an argument (such as claim, grounds, backing, qualifier). • Explain the role of grounds, backing, and qualifiers in a claim. • Summarize what each paragraph of an argument seems to be saying. • Annotate a text's central claims and the grounds for the claims. • Annotate the evidence, or backing, given in a text. • Annotate qualifiers in a claim. • Use a graphic organizer to compare the claims and evidence for two arguments. **ACER2—**The student will recognize or recall specific vocabulary (for example, *accurate*, *cite*, *claim*, *credible*, *evidence*, *irrelevant*, *relevant*, *source*, *sufficient*) and perform basic processes such as: • List different kinds of evidence that texts can use (such as statistics, quotes, historical facts). • Describe what makes evidence relevant, sufficient, credible, and accurate. • Outline the evidence for a claim in a text. • Annotate evidence in an argument that cites a source. • Rate the strength of a piece of evidence. **ACER3—**The student will recognize or recall specific vocabulary (for example, *argument*, *conclusion*, *fallacy*, *logic*, *premise*, *reasoning*, *premise*, *sound*, *unsound*) and perform basic processes such as: • Describe common fallacies (such as using an overly emotional argument, false appeals to authority, attacking the opponent instead of the argument). • Describe the difference between sound and unsound logic. • Annotate words that indicate a premise (such as *since*, *because*, *as an example*). • Annotate words that indicate a conclusion (such as *therefore*, *consequently*, *thus*). • Outline the logic of an argument (for example, show which premises lead to which conclusions).
1.5	Partial success at score 2.0 content, and major errors or omissions regarding score 3.0 content
1.0	With help, partial success at score 2.0 content and score 3.0 content
0.5	With help, partial success at score 2.0 content but not at score 3.0 content
0.0	Even with help, no success

Note several characteristics of the scale in table 9. First, each element at the score 3.0 level is unidimensional and includes an example to clarify its meaning. The three elements at the score 3.0 level also covary. *Covariance* means that two or more elements of knowledge or skill are so closely related that if student performance on one increases, student performance is likely to

also increase for the other. When measuring student learning using a proficiency scale, educators typically assign a score to a student for a specific measurement topic, rather than assigning separate scores for each of the elements within a measurement topic. Because a student will be assigned a score that measures their performance across all elements at the 3.0 level of the scale, all 3.0 elements within a measurement topic should covary.

The element at the score 4.0 level is more cognitively complex than the score 3.0 elements and requires the use of all of the score 3.0 elements in combination. It also includes an example to clarify its meaning.

The elements at the score 2.0 level of the scale in table 9 are aligned with specific elements at the 3.0 level. Additionally, each one is unidimensional; that is, it refers to only one aspect of simpler knowledge or skill. Finally, note the number of vocabulary terms and elements articulated at the score 2.0 level of the scale. The Critical Concepts proficiency scales were designed as menus that educators customize for their unique needs and situations. As described on pages 25–27, educators should select those vocabulary terms and elements at the 2.0 level that they intend to directly teach and assess.

Phase 8

Once proficiency scales like the one in table 9 had been composed for each measurement topic, phase 8 involved three rounds of review and revision. During each round of review and revision, the analysts who wrote the proficiency scales worked closely with a separate reviewer who offered comments and feedback focused on specific aspects of each scale that might require revision.

First Review

During the first review, the reviewer read each proficiency scale and annotated any part of the scale that did not meet the following criteria:

- Target elements (score 3.0) should be unidimensional.
- Target elements (score 3.0) should covary with each other within each scale (as performance on one goes up, performance on the other is also likely to go up).
- The more complex element (score 4.0) of a scale should require a higher level of cognitive complexity than the scale's target elements.
- The more complex element (score 4.0) should require the use of the scale's target content elements in combination.
- Simpler elements (score 2.0) should be unidimensional.
- Simpler elements (score 2.0) should align with their corresponding target elements.

Additionally, the reviewer flagged any potential areas of overlap in vertical progressions (that is, the same or very similar content articulated in scales on the same topic at different grade levels). For example, table 10 (page 22) shows the draft progression of target elements for Analyzing Language at grades 6, 7, 8, and 9–10 in ELA.

Table 10. Draft Progression of Target Elements for Analyzing Language

Grade 6	Grade 7	Grade 8	Grades 9–10
• Use resources and context to distinguish between words with multiple connotative or denotative meanings • Interpret the meaning of figurative and connotative language in a text • Analyze how specific words and instances of figurative language develop the tone of a text • Analyze how specific words and instances of figurative language develop the theme of a text	• Determine the denotative meaning of words and phrases by using context, word roots and affixes, or reference materials • Interpret the connotative and figurative meaning of words and phrases	• Determine the denotative meaning of words using reference materials, Greek and Latin roots and affixes, and context • Interpret the connotative meaning of words and the meaning of figurative language	• Determine the precise meaning(s) of words and phrases • Determine the meaning(s) of figurative language

In the draft progression in table 10, the grade 6 element "interpret the meaning of figurative and connotative language in a text" might be construed to be more complex than the grades 9–10 element "determine the meaning(s) of figurative language." The grade 7 element "interpret the connotative and figurative meaning of words and phrases" is almost identical to the grade 8 element "interpret the connotative meaning of words and the meaning of figurative language." Because of these issues, the progression shown in table 10 was flagged during phase 8's first review as not exhibiting a clear and logical progression of knowledge and skill from one grade level to the next.

When this occurred in the Critical Concepts proficiency scale drafts, it was usually an artifact of the source standards used in the analysis. For example, in the CCSS, there are several instances in which the standards do not change or only change slightly from one grade level to the next. Table 11 shows two such examples from the CCSS ELA standards.

In example 1 in table 11, the initial phrases of the standard are identical at all three grade levels shown. Additionally, the standards are identical at grades 6 and 8, except for the final phrase added at grade 8. In example 2 in table 11, the standards for grades 7 and 8 are identical and the standard for grade 6 is almost identical to the other two. Although such fine distinctions from grade level to grade level might be defensible from some perspectives, we assert that more clearly delineating the knowledge and skills that students are expected to master at each subsequent grade level is ultimately more useful to teachers and students, both for assessment and feedback purposes.

Table 11. Examples of Similar Standards at Multiple Grade Levels

	Grade 6	Grade 7	Grade 8
Example 1	Determine the meaning of words and phrases as they are used in a text, including figurative and connotative meanings; analyze the impact of a specific word choice on meaning and tone. (CCSS.ELA-LITERACY.RL.6.4)	Determine the meaning of words and phrases as they are used in a text, including figurative and connotative meanings; analyze the impact of rhymes and other repetitions of sounds (e.g., alliteration) on a specific verse or stanza of a poem or section of a story or drama. (CCSS.ELA-LITERACY.RL.7.4)	Determine the meaning of words and phrases as they are used in a text, including figurative and connotative meanings; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts. (CCSS.ELA-LITERACY.RL.8.4)
Example 2	Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources. (CCSS.ELA-LITERACY.W.6.8)	Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (CCSS.ELA-LITERACY.W.7.8)	Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (CCSS.ELA-LITERACY.W.8.8)

In response to reviewer feedback that a specific progression (such as the draft progression in table 10) either repeated or strongly overlapped from grade level to grade level, both analyst and reviewer conferred to determine the best way to create a clearer progression of knowledge and skills while ensuring that students would still learn the requisite knowledge and skills to succeed on large-scale assessments at each grade level. For the draft progression shown in table 10, the revisions made are shown in the final version of the progression presented in table 12.

Table 12. Final Progression of Target Elements for Analyzing Language

Grade 6	Grade 7	Grade 8	Grades 9–10
• Determine denotative meanings of words and phrases using context, roots, affixes, or reference materials • Determine connotative meanings of words and phrases • Describe figurative language in a text	• Explain how the connotative meanings of words and phrases impact a text's tone, mood, or theme(s) • Explain how figurative language impacts a text's tone, mood, or theme(s)	• Analyze how an author's word choice develops an analogy in a text • Describe the source(s) and meaning of allusions in a text	• Determine the precise meaning(s) of words and phrases • Explain the role and purpose of analogies and allusions in a text • Describe how an author's word choices affect the tone of a text

Notice that the progression in table 12 exhibits a clear, logical progression from one grade level to the next. At grade 6, students are expected to determine the denotative and connotative

meanings of words and phrases and describe instances of figurative language in a text. At grade 7, students must explain how the meaning of connotative and figurative language impact a text's tone, mood, or theme. At grade 8, students focus on two specific types of language: analogies and allusions. And at grades 9–10, students move beyond identifying and interpreting analogies and allusions towards articulating their role and purpose in a text. Additionally, at grades 9–10, students extend their analyses of how an author's word choices affect the tone of a text and increase the precision of their interpretations of words and phrases in a text. The revised, final progression preserves the essential knowledge and skills for each grade level presented in the source standards while clarifying the differences among what students are expected to learn and master at each grade level.

Second Review

During the second review of phase 8, the reviewer arranged the proficiency scales in vertical progressions to check and verify that the target content at higher grade levels logically built upon and was more complex than the target content at lower grade levels. Additionally, the reviewer examined each measurement topic title to ensure that its wording made vertical progressions as clear as possible. For charts showing the vertical progressions into which the scales were arranged during this review, see appendix D (page 41).

Third Review

The third review of phase 8 involved a close reading of the scales in grade level sets. The purpose of this review was to address any copyediting errors that were not caught during previous reviews and to ensure that all areas of concern raised during the first two reviews had been thoroughly addressed.

Table 13 reports the final number of measurement topics (and therefore, proficiency scales) for each content area at each grade level. See appendices A, B, and C (pages 30–40) for the final lists of measurement topics in each content area at each grade level.

Table 13. Number of Measurement Topics in the Critical Concepts

<table>
<tr><th></th><th>ELA</th><th>Mathematics</th><th>Science</th><th>Total</th></tr>
<tr><td>Kindergarten</td><td>18</td><td>10</td><td>9</td><td>37</td></tr>
<tr><td>Grade 1</td><td>20</td><td>9</td><td>11</td><td>40</td></tr>
<tr><td>Grade 2</td><td>19</td><td>14</td><td>11</td><td>44</td></tr>
<tr><td>Grade 3</td><td>19</td><td>14</td><td>13</td><td>46</td></tr>
<tr><td>Grade 4</td><td>18</td><td>15</td><td>15</td><td>48</td></tr>
<tr><td>Grade 5</td><td>15</td><td>14</td><td>10</td><td>39</td></tr>
<tr><td>Grade 6</td><td>15</td><td>16</td><td rowspan="3">31</td><td rowspan="3">122</td></tr>
<tr><td>Grade 7</td><td>14</td><td>15</td></tr>
<tr><td>Grade 8</td><td>15</td><td>16</td></tr>
<tr><td>Grade 9</td><td rowspan="2">14</td><td rowspan="4">64</td><td rowspan="4">36</td><td rowspan="4">128</td></tr>
<tr><td>Grade 10</td></tr>
<tr><td>Grade 11</td><td rowspan="2">14</td></tr>
<tr><td>Grade 12</td></tr>
<tr><td>Total</td><td>181</td><td>187</td><td>136</td><td>504</td></tr>
</table>

Using the Critical Concepts In Your School or District

Schools and districts interested in using the Critical Concepts have several options. First, a school or district might use the Critical Concepts measurement topics from appendices A, B, and C as a starting point for creating proficiency scales. Educators could use the lists as a foundation and proceed by adding or deleting topics according to their unique needs and situations. Once educators have a set of measurement topics they feel accurately represent the knowledge and skills their students should learn, they can compose proficiency scales for those topics.

Second, a school or district might begin by identifying those standards that they think are most important and then compare their list of essential content with the topics listed in appendices A, B, and C. Such a comparison provides an opportunity for educators to examine their decisions in the context of Marzano Research's analysis. As in the first option, educators can proceed to compose proficiency scales for their final list of topics.

Third, a school or district might decide to accelerate their journey toward a guaranteed and viable curriculum by purchasing the Critical Concepts proficiency scales created by Marzano Research and customizing the proficiency scales for their unique needs and situations. Such work can be more efficient and less cognitively difficult than generating original proficiency scales. If a school or district decides to purchase the Critical Concepts proficiency scales, they should plan for educators to spend time validating the measurement topics and customizing the proficiency scales for their specific context.

Validating the Critical Concepts Measurement Topics

The process of validating the Critical Concepts begins by matching school or district standards to the Critical Concepts measurement topics and comparing the standards to the 3.0 elements within each measurement topic. Any gaps or overlaps should be noted; if knowledge or skills deemed essential for the school or district are not included in the Critical Concepts, they can be added as either 3.0 elements within an existing measurement topic or as additional measurement topics.

To add knowledge or skills to the Critical Concepts proficiency scales, educators should first determine if any Critical Concepts measurement topics are closely related to the knowledge or skills being added. For example, if a school or district deemed that knowledge and skills related to collaboration were essential but were not included in the Critical Concepts, they might first check to see if any Critical Concepts measurement topics are closely related to collaboration. A crucial aspect of the decision to add new content within the 3.0 level of a proficiency scale is determining if the knowledge or skills to be added covary with the existing 3.0 elements in the measurement topic (see page 20 for an explanation of covariance). Additionally, we recommend that measurement topics have one to four (and no more than five) elements at the 3.0 level. Therefore, if a measurement topic already has three or four elements at the 3.0 level, it may be advisable to create a new measurement topic for additional knowledge or skills.

If content is articulated in the Critical Concepts that is not articulated in school or district standards, educators can delete the elements or measurement topics that contain such content.

Finally, if educators believe that elements grouped together in a single measurement topic in the Critical Concepts should actually be measured or scored separately, they can split a proficiency scale into two or more separate scales. As exemplified in table 9 (page 20), the Critical Concepts proficiency scales specify which elements of the simpler 2.0 content correspond to each element in the 3.0 section. This allows educators, if they wish, to create separate proficiency scales for each element in the 3.0 section by simply moving the 3.0 elements and their corresponding 2.0 content into separate proficiency scale documents and composing a statement of more complex 4.0 content for each element.

Regarding the decision to create separate proficiency scales for each 3.0 element from a Critical Concepts proficiency scale, we offer one cautionary note: Educators should keep in mind that when they move the 3.0 elements (and corresponding 2.0 elements) from a proficiency scale into separate proficiency scales, they are increasing the number of topics on which they will assign scores to students. For example, if an educator used the scale in table 9 as it is presented, he or she would assign scores for the topic of Analyzing Claims, Evidence, and Reasoning that reported a student's current level of knowledge and skill across all three elements at the 3.0 level. If an educator decided to split the proficiency scale in table 9 into three separate scales, he or she would assess and score students on each element separately. Thus, each student would have a set of scores for the element "compare arguments to alternate or opposing arguments," another set of scores for the element "evaluate the relevance, sufficiency, credibility, and accuracy of evidence for a specific claim," and another set of scores for the element "identify errors in reasoning (i.e., logical errors, fallacies) in an argument." It follows that a report card or tracking chart for a student would also list each element individually. In sum, as more proficiency scales are split, educators must keep track of more scores for each student.

Customizing the Critical Concepts Proficiency Scales

In the Critical Concepts proficiency scales, the simpler content articulated at the score 2.0 level is a list of possible vocabulary terms and basic processes and information that students could be expected to master as they work toward the 3.0 level elements. This does not imply that students must master everything listed at the score 2.0 level. Rather, educators should customize the proficiency scales for their specific school or district by selecting the most important vocabulary terms and basic processes at the 2.0 level. As a general rule, educators should select vocabulary terms and 2.0 elements that they intend to directly teach and assess.

For example, consider the proficiency scale in table 9. An educator might customize the level 2.0 section for the first element (ACER1) by narrowing the vocabulary list to three important terms: *argument*, *evidence*, and *reasoning*. Additionally, he or she might delete the first, second, and sixth elements and modify the fourth and fifth elements to create the revised vocabulary list and 2.0 elements for ACER1 shown in table 14.

Table 14. Customized 2.0 Section for Analyzing Claims, Evidence, and Reasoning at Grade 8

2.0	**ACER1—**The student will recognize or recall specific vocabulary (for example, *argument*, *evidence*, *reasoning*) and perform basic processes such as: • Summarize what each paragraph of an argument seems to be saying. • Annotate a text's central claims. • Annotate the evidence given in a text. • Use a graphic organizer to compare the claims and evidence for two arguments.

This revision process would be repeated for ACER2 and ACER3 and for the level 2.0 sections of other proficiency scales to create a focused set of proficiency scales that is customized to the unique needs and situation of an individual school or district. We recommend, however, that educators engage in this type of customization work as teams within a school or district; the final version of a proficiency scale for a school or district should be agreed to by all educators teaching the content contained within it, and all educators teaching that content at a specific grade level should use the same version of the proficiency scale.

Summary

This report summarizes the process used to select the Critical Concepts elements, organize them into measurement topics, and compose a proficiency scale for each measurement topic. Additionally, this report explains how a school or district might use the Critical Concepts measurement topics and proficiency scales to facilitate and accelerate their work toward a guaranteed and viable curriculum. While each school or district should customize the work described here for its unique situation and needs, our hope is that this project provides a useful foundation for such an endeavor.

Notes

1. The Critical Concepts articulate two sets of measurement topics for ELA at the high school level: grades 9–10 ELA and grades 11–12 ELA. As implied by this organization, students work on the same set of measurement topics and elements in grade 9 and grade 10 and the same set of measurement topics in grade 11 and grade 12, applying the knowledge and skills articulated in each proficiency scale to a wide range of texts. Before using the Critical Concepts proficiency scales, a school or district should articulate the specific texts to which students will apply the knowledge and skills articulated in each measurement topic at each grade level. For example, at grade 9, students might determine the main ideas or themes in texts such as Homer's *The Odyssey*, Steinbeck's *The Grapes of Wrath*, Lee's *To Kill A Mockingbird*, and Williams' *The Glass Menagerie*. At grade 10, students might determine the main ideas or themes in texts such as Ovid's *Metamorphoses*, Voltaire's *Candide*, Kafka's *The Metamorphosis*, and Shakespeare's *The Tragedy of Macbeth*.
2. Due to the structure of the science source standards used in our analysis, the Critical Concepts include proficiency scales related to engineering, the scientific method, and experiment design that stretch across grade bands rather than applying to specific grade levels. There are four sets of engineering proficiency scales which apply to the following grade bands: K–2, 3–5, middle school, and high school. Additionally, there is one scale related to the scientific method which spans grades K–5 and one scale related to experiment design which spans the middle school grades. To implement these scales at individual grade levels, we recommend that schools or districts design a list of grade-appropriate problems or investigations for each grade level to which the knowledge and skills articulated in the grade-band scales could be applied.
3. The Critical Concepts proficiency scales are written for an educator audience. However, proficiency scales are a powerful tool that students can use to monitor their own progress and take responsibility for their own learning. When introducing students to a proficiency scale, we recommend that educators work with students to translate each scale into student-friendly language. For example, a teacher might work with the students in her class to convert each element of a scale into an "I can" statement. Additional examples or sample tasks could also be added to facilitate students' understanding of what they are expected to know and be able to do to demonstrate mastery of a specific proficiency scale.

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APPENDIX A:
ENGLISH LANGUAGE ARTS MEASUREMENT TOPICS

Grades 11–12

Analyzing Text Organization and Structure
Analyzing Ideas and Themes
Analyzing Claims, Evidence, and Reasoning
Analyzing Narratives
Analyzing Point of View and Purpose
Analyzing Style and Tone
Comparing Texts
Analyzing Language
Generating Text Organization and Structure
Generating Claims, Evidence, and Reasoning
Sources and Research
Generating Narratives
Revision and Style
Editing

Grades 9–10

Analyzing Text Organization and Structure
Analyzing Ideas and Themes
Analyzing Claims, Evidence, and Reasoning
Analyzing Narratives
Analyzing Point of View and Purpose
Comparing Texts
Analyzing Language
Generating Text Organization and Structure
Generating Claims, Evidence, and Reasoning
Sources and Research
Generating Narratives
Audience, Purpose, and Task
Revision and Style
Editing

Grade 8

Analyzing Text Organization and Structure
Analyzing Ideas and Themes
Analyzing Claims, Evidence, and Reasoning
Analyzing Narratives
Analyzing Point of View and Purpose
Comparing Texts
Analyzing Language
Generating Text Organization and Structure
Generating Claims, Evidence, and Reasoning
Sources and Research
Generating Narratives
Audience, Purpose, and Task
Revision
Parts of Speech
Editing

Grade 7

Analyzing Text Organization and Structure
Analyzing Ideas and Themes
Analyzing Claims, Evidence, and Reasoning
Analyzing Narratives
Analyzing Point of View
Comparing Texts
Analyzing Language
Generating Text Organization and Structure
Generating Claims, Evidence, and Reasoning
Sources and Research
Generating Narratives
Audience, Purpose, and Task
Revision
Editing

Grade 6

Analyzing Text Organization and Structure
Analyzing Ideas and Themes
Analyzing Claims, Evidence, and Reasoning
Analyzing Narratives
Analyzing Point of View
Comparing Texts
Analyzing Language
Generating Text Organization and Structure
Generating Claims, Evidence, and Reasoning
Sources and Research
Generating Narratives
Audience, Purpose, and Task
Revision
Parts of Speech
Editing

Grade 5

Analyzing Text Organization and Structure
Analyzing Ideas and Themes
Analyzing Claims, Evidence, and Reasoning
Analyzing Narratives
Analyzing Point of View
Comparing Texts
Analyzing Language
Generating Text Organization and Structure
Generating Claims, Evidence, and Reasoning
Sources and Research
Generating Narratives
Audience, Purpose, and Task
Revision
Parts of Speech
Editing

Grade 4

Decoding
Analyzing Text Organization and Structure
Text Features
Text Types
Analyzing Ideas and Themes
Analyzing Claims, Evidence, and Reasoning
Analyzing Narratives
Analyzing Point of View
Comparing Texts
Analyzing Words
Analyzing Language
Generating Text Organization and Structure
Generating Claims, Evidence, and Reasoning
Sources and Research
Generating Narratives
Revision
Parts of Speech
Editing

Grade 3

Decoding
Analyzing Text Organization and Structure
Text Features
Text Types
Analyzing Ideas and Themes
Analyzing Claims, Evidence, and Reasoning
Analyzing Narratives
Analyzing Point of View
Comparing Texts
Analyzing Words
Analyzing Language
Generating Sentences
Generating Text Organization and Structure
Generating Claims, Evidence, and Reasoning
Sources and Research
Generating Narratives
Revision
Parts of Speech
Editing

Grade 2

Decoding
Analyzing Text Organization and Structure
Text Features
Analyzing Main Ideas
Analyzing Claims and Reasons
Analyzing Narratives
Analyzing Point of View
Comparing Texts
Analyzing Words
Analyzing Language
Generating Sentences
Generating Text Organization and Structure
Generating Claims and Reasons
Sources and Research
Generating Narratives
Revision
Parts of Speech
Spelling
Editing

Grade 1

Decoding
Phonological Awareness
Analyzing Text Organization and Structure
Text Features
Text Types
Analyzing Main Ideas
Analyzing Claims and Reasons
Analyzing Narratives
Analyzing Point of View
Comparing Texts
Analyzing Words
Analyzing Language
Generating Sentences
Generating Text Organization and Structure
Generating Claims and Reasons
Sources and Research
Generating Narratives
Parts of Speech
Spelling
Editing

Kindergarten

Decoding
Phonological Awareness
Print Concepts
Analyzing Text Organization and Structure
Text Features
Text Types
Analyzing Main Ideas
Analyzing Claims and Reasons
Analyzing Narratives
Comparing Texts
Analyzing Words
Generating Sentences
Generating Text Organization and Structure
Generating Claims
Sources and Research
Generating Narratives
Parts of Speech
Spelling

APPENDIX B:
MATHEMATICS MEASUREMENT TOPICS

High School

Rational Numbers and Expressions
Rational Exponents and Radicals
Components of an Expression
Context of an Expression
Adding and Subtracting Polynomial Expressions
Multiplying and Dividing Polynomial Expressions
Evaluating Polynomials
Factoring Expressions
Equations and Inequalities
Generating Equations and Inequalities
Linear Equations and Inequalities
Systems of Equations and Inequalities
Functional Relationships and Function Notation
Domain and Range of Functions
Quadratic Equations and Functions
Complex Numbers
Graphing Functions
Generating Functions
Comparing Functions
Inverse Functions
Polynomial, Radical, and Rational Functions
Combining Functions
Exponential and Logarithmic Functions
Arithmetic and Geometric Sequences
Finite Geometric Sequences
Volume of Three-Dimensional Figures
Non-Rigid Transformations
Transformations, Similarity, and Congruence
Properties of Parallelograms
Analyzing Geometric Figures
Parallel and Perpendicular Lines
Partitions of Line Segments
Angles and Transversals of Parallel Lines
Line and Angle Constructions
Polygons on the Coordinate Plane
Similarity in Triangles
Triangle Properties
Circumscribed and Inscribed Circles of Triangles
Components of a Circle
Proportions of a Circle
Angles of a Circle
Equation of a Circle
Conic Sections
Circle Polygon Constructions
Circle Area Measurements
Algebraic Data Representation and Interpretation
Data Comparisons
Probability
Probability and Combinatorics
Discrete Probability Distributions
Characteristics of Probability Distributions
Probability Density Functions
Statistical Investigations
Statistical Evaluations
Trigonometric Ratios
Trigonometric Ratios in Non-Right Triangles
Trigonometric Identities and Formulas
Trigonometric Functions on the Unit Circle
Modeling with Trigonometric Functions
Matrix Operations
Vector Operations
Linear Transformations
Matrix Determinants and Inverses
Complex Numbers on the Plane

Grade 8

Exponents
Cube and Square Roots
Scientific Notation
Rational and Irrational Numbers
Linear Equations
Systems of Linear Equations
Quadratic Equations
Concept of Functions
Linear Functions
Volume
Transformations, Similarity, and Congruence
Angles of Two-Dimensional Figures
Line and Angle Constructions
Pythagorean Theorem
Bivariate Categorical Data
Bivariate Measurement Data

Grade 7

Signed Numbers and Absolute Value
Converting Fractions, Decimals, and Percentages
Linear Equations
Proportional Relationships
Inequalities
Area and Volume
Analyzing Geometric Figures
Transformations of Geometric Figures
Angle Relationships
Constructing Triangles
Circles
Comparing Distributions
Representative Samples
Simple Probability Models
Probability of Compound Events

Grade 6

Signed Numbers and Absolute Value
Factors and Multiples
Long Division
Fraction Division
Evaluating Algebraic Expressions
Ratios, Rates, and Percentages
Algebraic Equations
Inequalities
Independent and Dependent Variables
Measurement Conversions
Area and Volume
Coordinate Plane
Measures of Central Tendency
Measures of Variability
Displaying Distributions
Analyzing Distributions

Grade 5

Multiplication and Division
Fraction Addition and Subtraction
Fraction Multiplication
Fraction Division
Decimal Place Values
Decimal Addition and Subtraction
Decimal Multiplication and Division
Exponents
Numerical Expressions
Numerical Patterns
Measurement Conversions
Volume
Two-Dimensional Figures
Coordinate Plane

Grade 4

Place Value
Addition and Subtraction
Multiplication
Division
Factors and Multiples
Equivalent Fractions
Fraction Addition and Subtraction
Fraction Multiplication
Decimal Fractions
Patterns
Measurement Conversions
Area and Perimeter
Two-Dimensional Figures
Angles
Lines

Grade 3

Estimation
Multiplication
Division
Word Problems
Fractions
Equivalent Fractions
Fractional Measurements
Patterns
Time
Mass and Liquid Volume
Area
Perimeter
Two-Dimensional Figures
Representing Categorical Data

Grade 2

Counting
Even and Odd Numbers
Number Lines and Line Plots
Place Value
Addition
Subtraction
Word Problems
Rectangular Arrays
Fractions
Length
Time
Money
Geometric Figures
Representing Categorical Data

Grade 1

Place Value
Addition
Subtraction
Addition and Subtraction Concepts
Length
Time
Geometric Figures
Partitions and Compositions of Geometric Figures
Representing Categorical Data

Kindergarten

Number Sequence
Counting Objects
Comparing Quantities
Decomposing Numbers
Addition
Subtraction
Measurement
Geometric Figures
Constructing Geometric Figures
Categorical Data

APPENDIX C:
SCIENCE MEASUREMENT TOPICS

High School

Energy Conversion
Changes in Energy
Entropy
Force
Gravity
Electromagnetism
Forces Within a Field
Electromagnetic Radiation
Information Technologies
Atomic Structure
Molecular-Level Structures
Chemical Reactions
Chemical Reaction Factors
Fission, Fusion, and Radioactive Decay
Celestial Objects
Big Bang Theory
Earth Systems
Earth Changes
Earth's History
Climate Change
Natural Hazards
Natural Resources
Organism Structure and Function
Carbon-Based Molecules
Cellular Respiration and Photosynthesis
Protein Synthesis
Homeostasis
Organism Traits
Genetic Variation
Natural Selection
Biological Evolution
Ecosystem Populations
Matter and Energy in Ecosystems
Biodiversity
Defining Engineering Design Problems
Solutions for Engineering Design Problems

Middle School

Energy
Energy Transfer
Motion
Gravity
Electromagnetism
Circuits
Waves
Chemical Reactions
Celestial Motion
Celestial Objects
Rock Cycle
Water Cycle
Earth Changes
Earth's History
Climate and Weather
Natural Hazards
Human Impact
Natural Resources
Synthetic Materials
Organism Needs
Organism Structure and Function
Organism Behavior
Organism Traits
Genetic Variation
Natural Selection
Evolutionary Relationships
Ecosystem Populations
Matter and Energy in Ecosystems
Defining Engineering Design Problems
Solutions for Engineering Design Problems
Experiment Design

Grade 5

Gravity
Matter
Properties of Matter
Celestial Motion
Celestial Objects
Earth Systems
Ecosystem Interactions

Grade 4

Energy
Motion
Light and Vision
Waves
Information Transfer
Geographic Features
Earth Changes
Earth's History
Natural Hazards
Natural Resources
Plant Needs
Animal Needs

Grade 3

Force
Motion
Electricity
Magnets
Climate and Weather
Natural Hazards
Comparing Organisms
Organism Behavior
Organism Traits
Organism Habitats

Grades 3–5

Defining Engineering Design Problems
Solutions for Engineering Design Problems

Grade 2

Object Composition
Properties of Materials
Changes to Materials
Geographic Features
Weathering and Erosion
Earth's History
Organism Needs
Biodiversity

Grade 1

Electricity
Light
Sound and Vibration
Celestial Motion
Seasons
Organism Needs
Comparing Organisms
Organism Behavior

Kindergarten

Solar Energy
Force and Motion
Weather
Human Impact
Organism Needs
Comparing Organisms

Grades K–2

Defining Engineering Design Problems
Solutions for Engineering Design Problems

Grades K–5

Scientific Method

APPENDIX D:
VERTICAL PROGRESSION CHARTS

English Language Arts

K	1	2	3	4	5	6	7	8	9-10	11-12
Decoding	Decoding	Decoding	Decoding	Decoding						
Phonological Awareness	Phonological Awareness									
Print Concepts										
Analyzing Text Organization and Structure	Analyzing Text Organization and Structure	Analyzing Text Organization and Structure	Analyzing Text Organization and Structure	Analyzing Text Organization and Structure	Analyzing Text Organization and Structure	Analyzing Text Organization and Structure	Analyzing Text Organization and Structure	Analyzing Text Organization and Structure	Analyzing Text Organization and Structure	Analyzing Text Organization and Structure
Text Features	Text Features	Text Features	Text Features	Text Features						
Text Types	Text Types		Text Types	Text Types						
Analyzing Main Ideas	Analyzing Main Ideas	Analyzing Main Ideas	Analyzing Ideas and Themes	Analyzing Ideas and Themes	Analyzing Ideas and Themes	Analyzing Ideas and Themes	Analyzing Ideas and Themes	Analyzing Ideas and Themes	Analyzing Ideas and Themes	Analyzing Ideas and Themes
Analyzing Claims and Reasons	Analyzing Claims and Reasons	Analyzing Claims and Reasons	Analyzing Claims, Evidence, and Reasoning	Analyzing Claims, Evidence, and Reasoning	Analyzing Claims, Evidence, and Reasoning	Analyzing Claims, Evidence, and Reasoning	Analyzing Claims, Evidence, and Reasoning	Analyzing Claims, Evidence, and Reasoning	Analyzing Claims, Evidence, and Reasoning	Analyzing Claims, Evidence, and Reasoning
Analyzing Narratives	Analyzing Narratives	Analyzing Narratives	Analyzing Narratives	Analyzing Narratives	Analyzing Narratives	Analyzing Narratives	Analyzing Narratives	Analyzing Narratives	Analyzing Narratives	Analyzing Narratives
	Analyzing Point of View	Analyzing Point of View	Analyzing Point of View	Analyzing Point of View	Analyzing Point of View	Analyzing Point of View	Analyzing Point of View	Analyzing Point of View and Purpose	Analyzing Point of View and Purpose	Analyzing Point of View and Purpose
										Analyzing Style and Tone
Comparing Texts	Comparing Texts	Comparing Texts	Comparing Texts	Comparing Texts	Comparing Texts	Comparing Texts	Comparing Texts	Comparing Texts	Comparing Texts	Comparing Texts
Analyzing Words	Analyzing Words	Analyzing Words	Analyzing Words	Analyzing Words						
	Analyzing Language	Analyzing Language	Analyzing Language	Analyzing Language	Analyzing Language	Analyzing Language	Analyzing Language	Analyzing Language	Analyzing Language	Analyzing Language
Generating Sentences	Generating Sentences	Generating Sentences	Generating Sentences							
Generating Text Organization and Structure	Generating Text Organization and Structure	Generating Text Organization and Structure	Generating Text Organization and Structure	Generating Text Organization and Structure	Generating Text Organization and Structure	Generating Text Organization and Structure	Generating Text Organization and Structure	Generating Text Organization and Structure	Generating Text Organization and Structure	Generating Text Organization and Structure
Generating Claims	Generating Claims and Reasons	Generating Claims and Reasons	Generating Claims, Evidence, and Reasoning	Generating Claims, Evidence, and Reasoning	Generating Claims, Evidence, and Reasoning	Generating Claims, Evidence, and Reasoning	Generating Claims, Evidence, and Reasoning	Generating Claims, Evidence, and Reasoning	Generating Claims, Evidence, and Reasoning	Generating Claims, Evidence, and Reasoning
Sources and Research	Sources and Research	Sources and Research	Sources and Research	Sources and Research	Sources and Research	Sources and Research	Sources and Research	Sources and Research	Sources and Research	Sources and Research
Generating Narratives	Generating Narratives	Generating Narratives	Generating Narratives	Generating Narratives	Generating Narratives	Generating Narratives	Generating Narratives	Generating Narratives	Generating Narratives	Generating Narratives
					Audience, Purpose, and Task	Audience, Purpose, and Task	Audience, Purpose, and Task	Audience, Purpose, and Task	Audience, Purpose, and Task	
		Revision	Revision	Revision	Revision	Revision	Revision	Revision	Revision and Style	Revision and Style
Parts of Speech	Parts of Speech	Parts of Speech	Parts of Speech	Parts of Speech	Parts of Speech	Parts of Speech		Parts of Speech		
Spelling	Spelling	Spelling								
	Editing	Editing	Editing	Editing	Editing	Editing	Editing	Editing	Editing	Editing

Mathematics

K	1	2	3	4	5	6	7	8	HS
• Number Sequence • Counting Objects • Comparing Quantities		• Counting • Even and Odd Numbers • Number Lines and Line Plots				• Signed Numbers and Absolute Value	• Signed Numbers and Absolute Value		
	• Place Value	• Place Value	• Estimation	• Place Value					
• Decomposing Numbers • Addition • Subtraction	• Addition • Subtraction • Addition and Subtraction Concepts	• Addition • Subtraction • Word Problems		• Addition and Subtraction					
		• Rectangular Arrays	• Multiplication • Division • Word Problems	• Multiplication • Division • Factors and Multiples	• Multiplication and Division	• Factors and Multiples • Long Division			• Factoring Expressions
		• Fractions	• Fractions • Equivalent Fractions • Fractional Measurements	• Equivalent Fractions • Fraction Addition and Subtraction • Fraction Multiplication • Decimal Fractions	• Fraction Addition and Subtraction • Fraction Multiplication • Fraction Division • Decimal Place Values • Decimal Addition and Subtraction • Decimal Multiplication and Division	• Fraction Division	• Converting Fractions, Decimals, and Percentages		
					• Exponents			• Exponents • Cube and Square Roots • Scientific Notation • Rational and Irrational Numbers	• Rational Numbers and Expressions • Rational Exponents and Radicals
					• Numerical Expressions	• Evaluating Algebraic Expressions			• Components of an Expression • Context of an Expression • Adding and Subtracting Polynomial Expressions • Multiplying and Dividing Polynomial Expressions • Evaluating Polynomials

Mathematics (continued)

K	1	2	3	4	5	6	7	8	HS
						• Ratios, Rates, and Percentages • Algebraic Equations • Inequalities • Independent and Dependent Variables	• Linear Equations • Proportional Relationships • Inequalities	• Linear Equations • Systems of Linear Equations • Quadratic Equations • Concept of Functions • Linear Functions	• Equations and Inequalities • Generating Equations and Inequalities • Linear Equations and Inequalities • Systems of Equations and Inequalities • Functional Relationships and Function Notation • Domain and Range of Functions • Quadratic Equations and Functions • Complex Numbers • Graphing Functions • Generating Functions • Comparing Functions • Inverse Functions • Polynomial, Radical, and Rational Functions • Combining Functions • Exponential and Logarithmic Functions
			• Patterns	• Patterns	• Numerical Patterns				• Arithmetic and Geometric Sequences • Finite Geometric Sequences
• Measurement	• Length • Time	• Length • Time • Money	• Time • Mass and Liquid Volume • Area • Perimeter	• Measurement Conversions • Area and Perimeter	• Measurement Conversions • Volume	• Measurement Conversions • Area and Volume	• Area and Volume	• Volume	• Volume of Three-Dimensional Figures
• Geometric Figures • Constructing Geometric Figures	• Geometric Figures • Partitions and Compositions of Geometric Figures	• Geometric Figures	• Two-Dimensional Figures	• Two-Dimensional Figures	• Two-Dimensional Figures		• Analyzing Geometric Figures • Transformations of Geometric Figures	• Transformations, Similarity, and Congruence	• Non-Rigid Transformations • Transformations, Similarity, and Congruence • Properties of Parallelograms • Analyzing Geometric Figures
				• Angles • Lines			• Angle Relationships	• Angles of Two-Dimensional Figures • Line and Angle Constructions	• Parallel and Perpendicular Lines • Partitions of Line Segments • Angles and Transversals of Parallel Lines • Line and Angle Constructions
					• Coordinate Plane	• Coordinate Plane			• Polygons on the Coordinate Plane

Mathematics (continued)

K	1	2	3	4	5	6	7	8	HS
							• Constructing Triangles • Circles	• Pythagorean Theorem	• Similarity in Triangles • Triangle Properties • Circumscribed and Inscribed Circles of Triangles • Components of a Circle • Proportions of a Circle • Angles of a Circle • Equation of a Circle • Conic Sections • Circle Polygon Constructions • Circle Area Measurements
• Categorical Data	• Representing Categorical Data	• Representing Categorical Data	• Representing Categorical Data			• Measures of Central Tendency • Measures of Variability • Displaying Distributions • Analyzing Distributions	• Comparing Distributions	• Bivariate Categorical Data • Bivariate Measurement Data	• Algebraic Data Representation and Interpretation • Data Comparisons
							• Representative Samples • Simple Probability Models • Probability of Compound Events		• Probability • Probability and Combinatorics • Discrete Probability Distributions • Characteristics of Probability Distributions • Probability Density Functions • Statistical Investigations • Statistical Evaluations
									• Trigonometric Ratios • Trigonometric Ratios in Non-Right Triangles • Trigonometric Identities and Formulas • Trigonometric Functions on the Unit Circle • Modeling with Trigonometric Functions
									• Matrix Operations • Vector Operations • Linear Transformations • Matrix Determinants and Inverses • Complex Numbers on the Plane

Science

K	1	2	3	4	5	MS	HS
• Solar Energy				• Energy		• Energy • Energy Transfer	• Energy Conversion • Changes in Energy • Entropy
• Force and Motion			• Force • Motion	• Motion	• Gravity	• Motion • Gravity	• Force • Gravity
	• Electricity • Light		• Electricity • Magnets	• Light and Vision		• Electromagnetism • Circuits	• Electromagnetism • Forces Within a Field • Electromagnetic Radiation
	• Sound and Vibration			• Waves • Information Transfer		• Waves	• Information Technologies
		• Object Composition • Properties of Materials • Changes to Materials			• Matter • Properties of Matter	• Chemical Reactions	• Atomic Structure • Molecular-Level Structures • Chemical Reactions • Chemical Reaction Factors • Fission, Fusion, and Radioactive Decay
	• Celestial Motion				• Celestial Motion • Celestial Objects	• Celestial Motion • Celestial Objects	• Celestial Objects • Big Bang Theory
		• Geographic Features		• Geographic Features	• Earth Systems	• Rock Cycle • Water Cycle	• Earth Systems
		• Weathering and Erosion		• Earth Changes		• Earth Changes	• Earth Changes
		• Earth's History		• Earth's History		• Earth's History	• Earth's History
• Weather	• Seasons		• Climate and Weather			• Climate and Weather	• Climate Change
			• Natural Hazards	• Natural Hazards		• Natural Hazards	• Natural Hazards
• Human Impact				• Natural Resources		• Human Impact • Natural Resources • Synthetic Materials	• Natural Resources
• Organism Needs	• Organism Needs	• Organism Needs		• Plant Needs • Animal Needs		• Organism Needs	
						• Organism Structure and Function	• Organism Structure and Function • Carbon-Based Molecules • Cellular Respiration and Photosynthesis • Protein Synthesis

Science (continued)

<table>
<tr><th>K</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>MS</th><th>HS</th></tr>
<tr><td>• Comparing Organisms</td><td>• Comparing Organisms
• Organism Behavior</td><td></td><td>• Comparing Organisms
• Organism Behavior</td><td></td><td></td><td>• Organism Behavior</td><td>• Homeostasis</td></tr>
<tr><td></td><td></td><td></td><td>• Organism Traits</td><td></td><td></td><td>• Organism Traits
• Genetic Variation</td><td>• Organism Traits
• Genetic Variation</td></tr>
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• Evolutionary Relationships</td><td>• Natural Selection
• Biological Evolution</td></tr>
<tr><td></td><td></td><td>• Biodiversity</td><td>• Organism Habitats</td><td></td><td>• Ecosystem Interactions</td><td>• Ecosystem Populations
• Matter and Energy in Ecosystems</td><td>• Ecosystem Populations
• Matter and Energy in Ecosystems
• Biodiversity</td></tr>
<tr><td colspan="3">• Defining Engineering Design Problems
• Solutions for Engineering Design Problems</td><td colspan="3">• Defining Engineering Design Problems
• Solutions for Engineering Design Problems</td><td>• Defining Engineering Design Problems
• Solutions for Engineering Design Problems
• Experiment Design</td><td>• Defining Engineering Design Problems
• Solutions for Engineering Design Problems</td></tr>
<tr><td colspan="6">• Scientific Method</td><td></td><td></td></tr>
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