Designing Cornerstone Tasks to Anchor the Curriculum

presented by

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Working with Standards using UbD

Stage 1 – Desired Results
What Standard(s) will the unit focus on?
Given your reasons for teaching the unit, which Standard(s) are most relevant?

Stage 2 – Assessment Evidence
What should students eventually be able to do on their own if they can meet the Standard?

Stage 3 – Learning Plan
What big ideas and transfer goals are embedded in this Standard?

What should students come to understand if they really learn this content well?
What factual knowledge must students acquire to meet the Standard?

What “real-world” tasks will reveal students’ understanding and proficiency?
What transfer performances should students be able to do well if they have met this standard?

What important questions are raised by this content?
What essential questions will guide inquiry into it?

What specific skills are stated or implied in the Standard?
What proficiencies must students attain to meet the Standard?

What evidence of learning is called for by the standard (and its indicators)? What assessments are needed?

What instruction is needed to equip students to meet this standard?
What learning experiences will help learners acquire the knowledge and skills, make meaning of the important ideas and equip them to transfer their learning?
Mapping a Coherent Curriculum: 
The Big Picture

Mission and Transfer Goals

Content Standards

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<th>Programs</th>
<th>Language Arts</th>
<th>Mathematics</th>
<th>Science</th>
<th>Arts</th>
<th>History</th>
<th>World Languages</th>
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Courses

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<th>Course 7</th>
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<td>Course 2</td>
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<td>Course 3</td>
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<td>Course 9</td>
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Units

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<th>Unit 1</th>
<th>Unit 2</th>
<th>Unit 3</th>
<th>Unit 4</th>
<th>Unit 5</th>
<th>Unit 6</th>
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</table>

Understandings

Cornerstone Assessments

Overarching Understandings

Overarching Essential Questions

Essential Questions
Students presented with vast amounts of content knowledge that is not organized into meaningful patterns are likely to forget what they have learned and to be unable to apply the knowledge to new problems or unfamiliar contexts (Haidar, 1997). Curriculum for understanding provides ample opportunity for students to apply their knowledge in a variety of contexts and conditions. This helps them transfer their learning to new situations and better prepares them for future learning (Bransford and Schwartz, 2000). Providing students with frequent opportunities to apply what they learn in multiple contexts requires a reallocation of instructional time. Allowing time for in-depth learning means decisions must be made about what knowledge is of most worth. For this reason, the curriculum needs to specify clearly the appropriate balance between breadth and depth of coverage in terms of student learning outcomes.

-- Committee on Programs for Advanced Study of Mathematics and Science in American High Schools

The Common Core State Standards in Mathematics
“…the mathematics curriculum in the United States must become substantially more focused and coherent in order to improve mathematics achievement …. To deliver on the promise of common standards, the standards must address the problem of a curriculum that is a mile wide and an inch deep. That is, what and how students are taught should reflect not only the topics that fall within a certain academic discipline, but also the key ideas that determine how knowledge is organized and generated within that discipline. This implies that ‘to be coherent,’ a set of content standards must evolve from particulars… to deeper structures inherent in the discipline.”

-- Common Core Mathematics Standards, p. 2

The (Draft) Common Core State Standards in Science
“The framework focuses on a limited number of core ideas in science and engineering both within and across the disciplines. The committee made this choice in order to avoid shallow coverage of a large number of topics and to allow more time for teachers and students to explore each idea in greater depth. Reduction of the sheer sum of details to be mastered is intended to give time for students to engage in scientific investigations and argumentation and to achieve depth of understanding of the core ideas presented. Delimiting what is to be learned about each core idea within each grade band also helps clarify what is most important to spend time on, and avoid the proliferation of detail to be learned with no conceptual grounding.

-- Common Core Science Standards (draft), p. I-4

Course Revisions to Advanced Placement (AP) Courses
“The revised AP Biology course addresses this challenge by shifting from a traditional “content coverage” model of instruction to one that focuses on enduring, conceptual understandings and the content that supports them. This approach will enable students to spend less time on factual recall and more time on inquiry-based learning of essential concepts, and will help them develop the reasoning skills necessary to engage in the science practices...”

“The AP World History Curriculum… is organized around key concepts and core themes, along with four Historical Thinking Skills:
1. Crafting Historical Arguments from Historical Evidence
2. Chronological Reasoning
3. Comparison and Contextualization
4. Historical Interpretation and Synthesis”

-- The College Board
English Language Arts Standards
College and Career Readiness

Anchor Standards for Reading

Key Ideas and Details
1. Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
3. Analyze how and why individuals, events, and ideas develop and interact over the course of a text.

Craft and Structure
4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
5. Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.
6. Assess how point of view or purpose shapes the content and style of a text.

Integration of Knowledge and Ideas
7. Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
8. Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
9. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.

Range of Reading and Level of Text Complexity
10. Read and comprehend complex literary and informational texts independently and proficiently.
English Language Arts Standards
College and Career Readiness

Anchor Standards for Writing

Text Types and Purposes
1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
3. Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details, and well-structured event sequences.

Production and Distribution of Writing
4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach.
6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

Research to Build and Present Knowledge
7. Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.
8. Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
9. Draw evidence from literary or informational texts to support analysis, reflection, and research.

Range of Writing
10. Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.
Key Conceptual Understandings and Processes in the Science Standards

Crosscutting Scientific and Engineering Concepts

1. **Patterns** – Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.

2. **Cause and Effect** – Mechanism and explanation. Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.

3. **Scale, Proportion, and Quantity** – In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system’s structure or performance.

4. **Systems and System Models** – Defining the system under study – specifying its boundaries and making explicit a model of that system – provides tools for understanding and testing ideas that are applicable throughout science and engineering.

5. **Energy and Matter** – Flows, cycles, and conservation. Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems’ possibilities and limitations.

6. **Structure and Function** – The way in which an object or living thing is shaped and its substructure determine many of its properties and functions.

7. **Stability and Change** – For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of the system are critical elements of study.

**Practices for K-12 Science Classrooms**

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics, information and computer technology, & computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information
The Partnership for 21st Century Skills

The Partnership for 21st Century Skills has developed a vision for 21st century student success in the new global economy. The Partnership created the Framework for 21st Century Learning, which describes the skills, knowledge and expertise students must master to succeed in work and life. Only when a school or district combines the framework with 21st century professional development, assessments and standards, can the American public be sure that high school graduates are prepared to thrive in today’s global economy.

21st century skills represent the necessary student outcomes for the 21st century, i.e. students need to obtain Learning and Innovation Skills (creativity and innovation, critical thinking and problem solving, etc.), Information, Media and Technology Skills, Core Subjects and 21st Century Themes (global awareness, financial literacy, etc.) and Life and Career Skills (initiative and self-direction, among others).

Learning and Innovation Skills
Learning and innovation skills are what separate students who are prepared for increasingly complex life and work environments in the 21st century and those who are not. They include:

- Creativity and Innovation
- Critical Thinking and Problem Solving
- Communication and Collaboration

Information, Media and Technology Skills
People in the 21st century live in a technology and media-driven environment, marked by access to an abundance of information, rapid changes in technology tools and the ability to collaborate and make individual contributions on an unprecedented scale. To be effective in the 21st century, citizens and workers must be able to exhibit a range of functional and critical thinking skills, such as:

- Information Literacy
- Media Literacy
- ICT (Information, Communications and Technology) Literacy

Life and Career Skills
Today’s life and work environments require far more than thinking skills and content knowledge. The ability to navigate the complex life and work environments in the globally competitive information age requires students to pay rigorous attention to developing adequate life and career skills, such as:

- Flexibility and Adaptability
- Initiative and Self-Direction
- Social and Cross-Cultural Skills
- Productivity and Accountability
- Leadership and Responsibility

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TRANSFER GOALS

Definition
Transfer Goals highlight the effective uses of understanding, knowledge, and skill we seek in the long run; i.e., what we want students to be able to do when they confront new challenges – both in and outside of school, beyond the current lessons and unit.

There are a small number of overarching transfer goals in each subject area. For example, a long-term aim in mathematics is for students to be able to solve any problem on their own. A long-term transfer goal in history is for students to apply the lessons of history to contemporary issues and to become more pro-active citizens based on their understanding. In world languages we want learners to be able to communicate effectively in the target language, in different situations. In every case, the ability to transfer learning manifests itself in not just one setting but varied real-world situations.

Transfer is about independent performance in context. You can only be said to have fully understood if you can apply your learning without someone telling you what to do and when to do it. In the real world, no teacher is there to direct and remind you about which lesson to plug in here or there. Transfer is about intelligently and effectively drawing from your repertoire, independently, to handle new contexts on your own.

Purpose
Effective transfer goals...

- reflect research on learning from multiple sources – cognitive psychology, neuroscience and studies of student achievement;
- resonate with our personal and professional experience in learning and teaching.

Examples
Health and Physical Education – Make healthful choices and decisions regarding diet, exercise, stress management, alcohol/drug use.

World Languages – Communicate effectively in realistic situations with an understanding of cultural and personal contexts.

See related materials in this packet and online.
Long Term Transfer Goals

Students will be able to independently use their learning to:

Writing
Effectively write in various genre for various audiences in order to Explain (narrative, expository), Entertain (creative), Persuade (persuasive), Help perform a task (technical), and Challenge or Change Things (satirical).

In this unit...

Reading
• Read, respond to text in various genres (literature, non-fiction, technical) for various purposes (entertainment, to be informed, to perform a task).
• Comprehend text by getting the main idea (the “gist”), interpreting (“between the lines”), critically appraising, and making personal connections.

Mathematics
• Recognize and solve never-seen-before, “messy” mathematical problems in which the appropriate solution approach is not obvious.

Health and Physical Education
• Make healthful choices and decisions regarding diet, exercise, stress management, alcohol/drug use.

Science
• Evaluate scientific claims (e.g., XX brand of paper towels absorbs the most liquid of all the leading brand), and analyze current issues involving science or technology. (e.g., Ethanol is the most cost-effective alternative fuel source.)

History
• Apply lessons of the past (patterns of history) to current and future events and issues, and to other historical events.
• Critically appraise historical and contemporary claims/decisions.

Performing Arts
• Interpret the meaning of works of art.
• Create and perform an original work in a selected medium to express ideas and/or to evoke mood and emotion.

World Languages
Effectively communicate with varied audiences and for varied purposes while displaying appropriate cultural understanding.
CORNERSTONE TASKS

Definition
Cornerstone tasks are curriculum-embedded that are intended to engage students in applying their knowledge and skills in an authentic and relevant context. Like a cornerstone anchors a building, these tasks are meant to anchor the curriculum around the most important performances that we want learners to be able to do (on their own) with acquired content knowledge and skills. They honor the intent of the Standards, within and across subject areas, instead of emphasizing only the tested (a.k.a. "eligible") content.

Purpose
Effective cornerstone tasks:
- are curriculum embedded (as opposed to externally imposed);
- recur over the grades, becoming increasingly sophisticated over time;
- establish authentic contexts for performance;
- assess understanding and transfer via genuine performance;
- integrate 21st century skills (e.g., critical thinking, technology use, teamwork) with subject area content;
- can be used as rich learning activities and/or assessments;
- evaluate performance with established rubrics;
- engage students in meaningful learning while encouraging the best teaching;
- provide content for a student’s portfolio (so that they graduate with a resume of demonstrated accomplishments rather than simply a transcript of courses taken).

Example
After investigating a current political issue, write a letter to a public policy maker regarding the official’s position on a current political issue. Your letter should present your opinion and attempt to persuade the public policy maker to vote accordingly. This public policy maker is opposed to the student’s position. (Students will be provided documentation of public policy maker’s position and background information. Students will be given a choice of several situations if they do not propose an issue.)
Examples of Recurring Cornerstone Tasks

[Science]

Upper Elementary/Middle School
The Pooper Scooper Kitty Litter Company claims that their litter is 40% more absorbent than other brands.

You are a Consumer Advocates researcher who has been asked to evaluate their claim. Develop a plan for conducting the investigation. Your plan should be specific enough so that the lab investigators could follow it to evaluate the claim.

High School
Design an investigation to answer the question, How much does it cost to take a shower?

Identify the variables that must be considered and then develop a plan for conducting the investigation. Your plan should be specific enough so that other investigators could follow it and answer the question.

[Social Studies]

Upper Elementary/Middle School
You have an idea that you believe will make your school better, and you want to convince school leaders that they should act on your idea. Identify your audience (e.g., principal, PTSA Board, students) and:

• Describe your idea.
• Explain why & how it will improve the school.
• Develop a plan for acting on your idea.

Your idea and plan can be communicated to your target audience in a letter, e-mail, or presentation.

High School
After investigating a current political issue, prepare a position paper/presentation for a public policy maker (e.g., Congress person) or group (e.g., school board, legislative committee). Assume that the policy maker or group is opposed to your position. Your position statement should provide an analysis of the issue, consider options, present your position, rebut opposing positions, and attempt to persuade the public policy maker or group to vote accordingly.

Your position can be communicated in a written report, via a web blog, or delivered as a presentation.
Cornerstone Tasks for World Languages

examples

Tour Director
[World Languages - secondary]

Level I – You are required to take a “trip” around the school (or town, or mall). Incorporate the following vocabulary: directions (left, right, near, far, next to, etc.), places (classrooms, cafeteria, gym, library, labs, churches, police and fire stations, schools, restaurants, stores) and transportation (bus, taxi, train, car, bike, stairs, escalators, elevators). Keep sentences simple and narrate – in the target language – your “trip” to five places using a variety of directions (and transportation).

Level II – You are to plan a trip to the capital of __________. You will be in that city for only two days. Keep a diary – in the target language – and tell which places you have visited and what you have seen. Be sure that these places are close enough to each other to be visited in a two-day period and are open on the days you will be there.

Level III – You have been selected by the members of the World Languages Club to plan their annual trip to two of the countries whose languages are studied in your school. You must plan an itinerary that will include at least five places of cultural and historic importance. You must include at lease one site/activity that might be of particular interest to teenagers (e.g. Euro-Disney, a bull fight or a soccer game). Use public transportation wherever possible. Create a brochure to advertise the trip and be prepared to give a presentation to those students who may be interested in traveling with you.

Level IV – You are traveling in the foreign country of your choice on business. Be prepared to role play with, a partner(s), making reservations with the airline and the hotel; narrate/role play: arriving and checking in at the airport in the U.S., going through customs upon landing, and getting to the hotel by taxi. Since you will have some limited time when you are not involved in your business dealings, you will want to make some brief cultural excursions and will need to get information from and make arrangements with the concierge in your hotel.

Source: World languages Department – Woodbury High School, Woodbury, NJ
<table>
<thead>
<tr>
<th>GRADE</th>
<th>Creative/Expressive</th>
<th>Literary Analysis</th>
<th>Expository</th>
<th>Persuasive</th>
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</thead>
<tbody>
<tr>
<td>Grade 6</td>
<td>Original myth</td>
<td>Literary essay on setting or conflict</td>
<td>Research report</td>
<td>Position paper</td>
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<tr>
<td>Grade 7</td>
<td>Persona writing</td>
<td>Literary essay on character</td>
<td>Autobiography report</td>
<td>Policy evaluation</td>
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<td>Grade 8</td>
<td>Narrative fiction</td>
<td>Literary essay on symbolism</td>
<td>Cause/effect essay</td>
<td>Problem/solution essay</td>
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<tr>
<td>Grade 9</td>
<td>Poetry</td>
<td>Analysis of multiple literary elements</td>
<td>Research report</td>
<td>Editorial</td>
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<tr>
<td>Grade 10</td>
<td>Historical</td>
<td>Critical Lens essay</td>
<td>Definition essay</td>
<td>Social issue essay</td>
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<tr>
<td>Grade 11</td>
<td>Parody/satire</td>
<td>Comparative genre essay</td>
<td>Research paper</td>
<td>Argumentative essay</td>
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<tr>
<td>Grade 12</td>
<td>Irony</td>
<td>Response to literary criticism</td>
<td>Research paper</td>
<td>Position paper</td>
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</tbody>
</table>
What is Understanding?

Part 1 – How would you define “understanding”? What does it mean to “really understand” or “get it”?

Understanding:

Part 2 - What are concrete indicators of really understanding something (as apposed to merely knowing important facts about it)? What can the person with understanding do that the person with only knowledge – even lots of knowledge – cannot do?

<table>
<thead>
<tr>
<th>Indicators of Understanding</th>
<th>Indicators of Knowledge without Understanding</th>
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The Facets of Understanding

The facets of understanding provide *indicators* of understanding and thus can be used to select or develop assessments. *If someone really understands something, they can...*

**Explanation**
- Explain it in their own words.
- Represent it in a different form.
- Teach it to someone else.
- Make and support an inference.
- Use their learning effectively in a new situation.
- Transfer.

**Interpretation**
- Make meaning from a text or data set.
- See and describe patterns.
- Make new connections.

**Application**
- Recognize different points of view.
- See the “big picture.”
- Take a critical stance.

**Empathy**
- Get “inside” another person’s feelings and world view.
- Recognize merit in the odd, unorthodox, or unfamiliar.

**Perspective**
- Realize their strengths and weaknesses.
- Recognize the limits of their own understanding.
- Reflect on their learning and actions.

**Self-Knowledge**
### Creating Cornerstone Assessments Tasks:
#### Idea Starters in Social Studies

<table>
<thead>
<tr>
<th>Evaluate historical claims or interpretations based on:</th>
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<tbody>
<tr>
<td>- Primary source evidence</td>
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<tr>
<td>- Secondary source evidence</td>
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<tr>
<td>- Personal opinion</td>
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</tbody>
</table>

<table>
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<tr>
<th>Critically analyze current events/ issues</th>
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<tbody>
<tr>
<td>- Summarize/ compare key points</td>
</tr>
<tr>
<td>- Analyze causes and effects</td>
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<tr>
<td>- Identify points of view and potential bias</td>
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<tr>
<td>- Debate possible courses of action</td>
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| Make predictions for current or future events or issues based on understanding of historical patterns. |
|                                                                                                       |

| Make informed decisions using critical thinking and understanding of historical patterns. |
|                                                                                           |

| Act as a responsible citizen in a democracy (e.g., stay informed, study issues, participate in community events, vote). |
|                                                                                                                   |

Other: ____________________________________________________________

________________________________________
## Matrix Method -- Mathematics Common Core Standards

<table>
<thead>
<tr>
<th>Practice Standards</th>
<th>1 Make sense of problems and persevere in solving them.</th>
<th>2 Reason abstractly and quantitatively.</th>
<th>3 Construct viable arguments and critique the reasoning of others.</th>
<th>4 Model with mathematics.</th>
<th>5 Use appropriate tools strategically.</th>
<th>6 Attend to precision.</th>
<th>7 Look for and make use of structure.</th>
<th>8 Look for and express regularity in repeated reasoning.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH GR 3</td>
<td>Represent and solve problems involving multiplication and division.</td>
<td>Understand properties of multiplication and the relationship between multiplication and division.</td>
<td>Multiply and divide within 100.</td>
<td>Solve problems involving the four operations, and identify and explain patterns in arithmetic.</td>
<td>Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.</td>
<td>Use place value understanding and properties of operations to perform multi-digit arithmetic.</td>
<td>Develop understanding of fractions as numbers.</td>
<td>Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.</td>
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</tbody>
</table>
Unpacking Standards – “Matrix” Method

Common Core State Standards
Mathematics

Content Standards

Grade 3:
- Represent and solve problems involving multiplication and division.
- Understand properties of multiplication and the relationship between multiplication and division.
- Multiply and divide within 100.
- Solve problems involving the four operations, and identify and explain patterns in arithmetic.
- Use place value understanding and properties of operations to perform multi-digit arithmetic.
- Develop understanding of fractions as numbers.
- Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.
- Represent and interpret data.
- Geometric measurement: understand concepts of area and relate area to multiplication and to addition.
- Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures.
- Reason with shapes and their attributes.

Process Standards

Standards for Mathematical Practice:
- 1. Make sense of problems and persevere in solving them.
- 2. Reason abstractly and quantitatively.
- 3. Construct viable arguments and critique the reasoning of others.
- 4. Model with mathematics.
- 5. Use appropriate tools strategically.
- 6. Attend to precision.
- 7. Look for and make use of structure.
- 8. Look for and express regularity in repeated reasoning.

TRANSFER GOAL(S) Students will be able to independently use their learning to...

Collect, organize, display data on real-world phenomena; analyze data to identify patterns; use patterns to make predictions; communicate clearly using mathematical terminology.

PERFORMANCE TASK Ideas

Every seven weeks students work in groups of four to measure the height of each other using tape measures affixed to the classroom walls. By mid-May, the class has obtained six height measures. Then, students create a simple graph (height in inches plotted against the months of the school year) and plot the data. Using rulers, they connect the dots to see “rise over run” (a visual representation of their growth over time). The chart papers are posted throughout the room, and the students circulate in a gallery walk to view the changes in heights of the various groups.

Students then analyze the data to answer guiding questions: “In what months did we grow the most this year?” “Is there a difference between how boys and girls have grown in second grade?” “How does our class growth compare to that in the other second grades?” “What can we predict for next year’s second graders about how they will grow based on our data?” Students are then work in their groups to develop a presentation for the current 2nd graders to predict how much they will grow in 3rd grade.
### Core Concepts of Science and Engineering

1. **Patterns.** Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.
2. **Cause and effect.** Mechanism and explanation. Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.
3. **Scale, proportion, and quantity.** In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system’s structure or performance.
4. **Systems and system models.** Defining the system under study – specifying its boundaries and making explicit a model of that system – provides tools for understanding and testing ideas that are applicable throughout science and engineering.
5. **Energy and matter.** Flows, cycles, and conservation. Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems’ possibilities and limitations.
6. **Structure and function.** The way in which an object or living thing is shaped and its substructure determine many of its properties and functions.
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###内容标准

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</tr>
<tr>
<td>✔ 3. <strong>Scale, proportion, and quantity.</strong> In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system’s structure or performance.</td>
</tr>
<tr>
<td>✔ 4. <strong>Systems and system models.</strong> Defining the system under study – specifying its boundaries and making explicit a model of that system – provides tools for understanding and testing ideas that are applicable throughout science and engineering.</td>
</tr>
<tr>
<td>✔ 5. <strong>Energy and matter.</strong> Flows, cycles, and conservation. Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems’ possibilities and limitations.</td>
</tr>
<tr>
<td>✔ 7. <strong>Stability and change.</strong> For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of the system are critical elements of study.</td>
</tr>
</tbody>
</table>

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###设计和执行一个科学实验并报告结果

**任务1** - **如何通过运动影响脉搏率？**
设计并执行一个比较正常脉搏率和由两种选定的体育活动（例如，慢跑、游泳、俯卧撑、深蹲）引起的脉搏率变化的实验。为指定的间隔准备一份报告，包括:
- 一个关于稳态、氧/二氧化碳反馈循环、脉搏率影响的解释
- 对结果的解释

在你的报告中回答这些问题 - **运动期间的脉搏率与正常（静息）脉搏率的比较**？ **二氧化碳和氧水平如何影响心率？运动期间心率如何影响脉搏率？这项运动如何影响稳态？呼吸速率也受到影响吗？**

**任务2** - 设计并执行一个科学实验来测试哪种四种抗酸药物最有效于中和酸。准备一份（新闻文章、播客、幻灯片演示、Animoto 动画）来向公众沟通你的发现。

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*Source: pals.sri.com*
# Mapping Cornerstone Tasks

21st Century Skills:  
- a. Critical/Creative Thinking  
- b. Problem Solving  
- c. Technology Use  
- d. Communication  
- e. Collaboration

<table>
<thead>
<tr>
<th>Key Program Goals:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. _______________</td>
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<tr>
<td>2. _______________</td>
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<td>3. _______________</td>
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<td>4. _______________</td>
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<td>5. _______________</td>
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<td>6. _______________</td>
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<td>7. _______________</td>
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<tr>
<td>8. _______________</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>High School Courses</th>
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</thead>
<tbody>
<tr>
<td>K</td>
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<tr>
<td>1</td>
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<td>2</td>
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<td>6</td>
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<td>7</td>
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<tr>
<td>8</td>
</tr>
</tbody>
</table>
Common Analytic Speaking Rubric for World Languages

<table>
<thead>
<tr>
<th>Comprehensibility</th>
<th>Fluency</th>
<th>Pronunciation</th>
<th>Vocabulary</th>
<th>Language Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Speech continuous with few pauses or stumbling.</td>
<td>Accurate pronunciation enhances communication.</td>
<td>Rich use of vocabulary enhances communication.</td>
<td>Accurate control of basic language structures.</td>
</tr>
<tr>
<td>3</td>
<td>Some hesitation but manages to continue and complete thoughts.</td>
<td>Infrequent mispronunciations do not interfere with communication.</td>
<td>Adequate and accurate use of vocabulary for this level enhances communication.</td>
<td>Generally accurate control of basic language structures.</td>
</tr>
<tr>
<td>2</td>
<td>Speech choppy and/or slow with frequent pauses; few or no incomplete thoughts.</td>
<td>Misprounciations sometimes interfere with communication.</td>
<td>Inadequate and/or inaccurate use of vocabulary sometimes interferes w/ communication.</td>
<td>Emerging use of basic language structures.</td>
</tr>
<tr>
<td>1</td>
<td>Speech halting and uneven with long pauses or incomplete thoughts.</td>
<td>Frequent mispronunciations greatly interfere with communication.</td>
<td>Inadequate and/or inaccurate use of vocabulary greatly interferes with communication.</td>
<td>Inadequate and/or inaccurate use of basic language structures.</td>
</tr>
</tbody>
</table>

Source: Fairfax County, VA Public Schools  http://www.fcps.edu/DIS/OHSICS/forlang/PALS/rubrics/
<table>
<thead>
<tr>
<th>SKILL AREA</th>
<th>6 Responses at this level:</th>
<th>5 Responses at this level:</th>
<th>4 Responses at this level:</th>
<th>3 Responses at this level:</th>
<th>2 Responses at this level:</th>
<th>1 Responses at this level:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meaning: the extent to which the writing exhibits sound understanding, analysis, and explanation, of the writing task and text(s)</td>
<td>• convey an accurate and in-depth understanding of the topic, audience, and purpose for the writing task</td>
<td>• offer insightful and thorough analysis and explanation in support of the argument or position</td>
<td>• convey an accurate and complete understanding of the topic, audience, and purpose for the writing task</td>
<td>• offer clear and explicit analysis and explanation in support of the argument or position</td>
<td>• convey a partly accurate understanding of the topic, audience, and purpose for the writing task</td>
<td>• provide no evidence of understanding the writing task or topic; make incoherent explanations that do not support the argument or position</td>
</tr>
<tr>
<td>Development: the extent to which ideas are elaborated using specific and relevant details and/or evidence to support the thesis</td>
<td>• support the position clearly and consistently with arguments that effectively integrate and elaborate on specific ideas and textual evidence from a variety of sources; anticipate and somewhat convincingly refute opposing viewpoints</td>
<td>• support the position clearly and consistently with arguments that incorporate and explain ideas and specific textual evidence from a variety of sources; anticipate and attempt to refute opposing viewpoints at a basic level</td>
<td>• support the position partially, using some ideas and textual evidence but without much elaboration or from limited sources; partially anticipate and with a limited or confused attempt to refute opposing viewpoints but</td>
<td>• attempt to support the position, but textual ideas and evidence is vague, repetitive, or unjustified; allude to opposing viewpoints but make no attempt to argue or refute opposing viewpoints</td>
<td>• completely lack development and do not include textual evidence; make no attempt to anticipate or refute opposing viewpoints</td>
<td></td>
</tr>
<tr>
<td>Organization: the extent to which the writing establishes a clear thesis and maintains direction, focus, and coherence</td>
<td>• skillfully establish and maintain consistent focus on a clear and compelling thesis; exhibit logical and coherent structure with claims, evidence and interpretations that support the thesis; make skillful use of transition words and phrases</td>
<td>• effectively establish and maintain consistent focus on a clear thesis; exhibit a logical sequence of claims, evidence, and interpretations to support the thesis; make effective use of transition words and phrases</td>
<td>• establish and maintain focus on a clear thesis; exhibit a logical sequence of claims, evidence, and interpretations but ideas within paragraphs are not consistently organized; make some attempt to use basic transition words and phrases</td>
<td>• establish but fail to consistently maintain focus on a basic thesis; exhibit a basic structure but lack the coherence of consistent claims, evidence, and interpretations; make an inconsistent attempt to use some basic transition words and phrases</td>
<td>• establish a confused or irrelevant thesis and fail to maintain focus; exhibit an attempt to organize ideas into a beginning, middle, and end, but lack coherence; make little attempt to use transition words and phrases</td>
<td>• fail to include a thesis or maintain focus; complete lack of organization and coherence; make no attempt to use transition words and phrases</td>
</tr>
<tr>
<td>Language: the extent to which the writing reveals an awareness of audience and purpose through word choice and sentence variety</td>
<td>• are stylistically sophisticated, using language that is precise and engaging, with a notable sense of voice and awareness of audience and purpose; effectively incorporate a range of varied sentence patterns to reveal syntactic fluency</td>
<td>• use language that is fluent and original, with evident awareness of audience and purpose; incorporate varied sentence patterns that reveal an awareness of different syntactic structures</td>
<td>• rely on basic vocabulary, with little awareness of audience or purpose; reveal a limited awareness of how to vary sentence patterns and rely on a limited range syntactic structures</td>
<td>• use language that is imprecise or unsuitable for the audience or purpose; reveal a confused understanding of how to write in complete sentences and little or no ability to vary sentence patterns</td>
<td>• use language that is incoherent or inappropriate; include a preponderance of sentence fragments and run-ons that significantly hinder comprehension</td>
<td></td>
</tr>
<tr>
<td>Conventions: the extent to which the writing exhibits conventional spelling, punctuation, paragraphing, capitalization, and</td>
<td>• demonstrate control of the conventions with essentially no errors, even with sophisticated language</td>
<td>• demonstrate control of the conventions, exhibiting occasional errors only when using sophisticated language (e.g., punctuation of complex sentences)</td>
<td>• demonstrate partial control, exhibiting occasional errors that do not hinder comprehension (e.g., incorrect use of homonyms)</td>
<td>• demonstrate emerging control, exhibiting frequent errors that somewhat hinder comprehension (e.g., agreement of pronouns and antecedents; spelling of basic words)</td>
<td>• demonstrate lack of control, exhibiting frequent errors that make comprehension difficult (e.g., subject verb agreement; use of slang)</td>
<td>• illegible or unrecognizable as literate English</td>
</tr>
</tbody>
</table>
Performance List for Writing Fiction

*Primary Level*

<table>
<thead>
<tr>
<th></th>
<th>Terrific</th>
<th>O.K.</th>
<th>Needs Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I have an interesting setting and characters for my story.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. The problem in my story will be clear to my readers.</td>
<td><img src="Image" alt="Face" /></td>
<td><img src="Image" alt="Face" /></td>
<td><img src="Image" alt="Face" /></td>
</tr>
<tr>
<td>3. My story events are in order.</td>
<td><img src="Image" alt="Face" /></td>
<td><img src="Image" alt="Face" /></td>
<td><img src="Image" alt="Face" /></td>
</tr>
<tr>
<td>4. The solution will be clear to my readers.</td>
<td><img src="Image" alt="Face" /></td>
<td><img src="Image" alt="Face" /></td>
<td><img src="Image" alt="Face" /></td>
</tr>
<tr>
<td>5. I used many describing words to tell what is happening.</td>
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<td><img src="Image" alt="Face" /></td>
<td><img src="Image" alt="Face" /></td>
</tr>
<tr>
<td>6. My words “paint a picture.”</td>
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<td><img src="Image" alt="Face" /></td>
<td><img src="Image" alt="Face" /></td>
</tr>
<tr>
<td>7. I have a title that goes with my story.</td>
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<td><img src="Image" alt="Face" /></td>
<td><img src="Image" alt="Face" /></td>
</tr>
</tbody>
</table>

What will you try to do better the next time you write a story?
Generic Rubric for 21st Century Skills

INFORMATION GATHERING and PROCESSING

Effectively uses a variety of information-gathering techniques and information resources.
4 Uses the important information-gathering techniques and information resources necessary to complete the task. Identifies little-known information resources or uses unique information-gathering techniques.
3 Uses the important information-gathering techniques and information resources necessary to complete the task.
2 Fails to use some significant information-gathering techniques and information resources necessary to complete the task.
1 Fails to use the most important information-gathering techniques or the major information resources necessary to complete the task.

Effectively interprets and synthesizes information.
4 Interprets the information gathered for a task in accurate and highly insightful ways. Provides a highly creative and unique synthesis of the information.
3 Accurately interprets information gathered for a task and concisely synthesizes it.
2 Makes significant errors in interpreting the information gathered for a task or synthesizes the information imprecisely or awkwardly.
1 Grossly misinterprets the information gathered for the task or fails to synthesize it.

Accurately assesses the value of information.
4 Analyzes information in detail, accurately and insightfully determining whether it is credible and relevant to a specific task.
3 Accurately determines whether information is credible and relevant to a specific task.
2 Makes some significant errors in determining whether information is credible and relevant to a specific task.
1 Makes little or no attempt to determine whether information is credible and relevant to a specific task or totally misjudges the relevance and credibility of information.

Recognizes where and how projects would benefit from additional information.
4 Insightfully determines the types of information that will benefit a task and effectively seeks out that information.
3 Accurately assesses a task to identify areas requiring additional information for clarification or support and seeks out the needed information.
2 Does not accurately assess the information needs of the task or fails to seek out needed information.
1 Makes little or no attempt to assess whether a task would benefit from additional information.
Generic Rubric for 21st Century Skills

COLLABORATION and TEAMWORK

Works towards the achievement of group goals.
4 Actively helps identify group goals and works hard to meet them.
3 Communicates commitment to the group goals and effectively carries out assigned roles.
2 Communicates a commitment to the group goals but does not carry out assigned roles.
1 Does not work toward group goals or actively works against them.

Demonstrates effective interpersonal skills.
4 Actively promotes effective group interaction and the expression of ideas and opinions in a way that is sensitive to the feelings and knowledge base of others.
3 Participates in group interaction without prompting. Expresses ideas and opinions in a way that is sensitive to the feelings and knowledge base of others.
2 Participates in group interaction with prompting or expresses ideas and opinions without considering the feelings and knowledge base of others.
1 Does not participate in group interaction, even with prompting, or expresses ideas and opinions in a way that is insensitive to the feelings or knowledge base of others.

Contributes to group maintenance.
4 Actively helps the group identify changes or modifications necessary in the group process and works toward carrying out those changes.
3 Helps identify changes or modifications necessary in the group process and works toward carrying out those changes.
2 When prompted, helps identify changes or modifications necessary in the group process, or is only minimally involved in carrying out those changes.
1 Does not attempt to identify changes or modifications necessary in the group process, even when prompted, or refuses to work toward carrying out those changes.

Effectively performs a variety of roles within a group.
4 Effectively performs multiple roles within the group.
3 Effectively performs two roles within the group.
2 Makes an attempt to perform more than one role within the group but has little success with secondary roles.

Cornerstone Task Review Criteria

<table>
<thead>
<tr>
<th>CRITERIA</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The task addresses/assesses targeted standard(s) and associated</td>
<td>3 2 1</td>
</tr>
<tr>
<td>Mission-related goals.</td>
<td></td>
</tr>
<tr>
<td>2. The task involves a complex, real-world (i.e., “authentic”)</td>
<td>3 2 1</td>
</tr>
<tr>
<td>application of knowledge and skills.</td>
<td></td>
</tr>
<tr>
<td>3. The task calls for understanding and transfer, not simply recall or</td>
<td>3 2 1</td>
</tr>
<tr>
<td>a formulaic response.</td>
<td></td>
</tr>
<tr>
<td>4. The task requires explanation and/or support – not just an answer.</td>
<td>3 2 1</td>
</tr>
<tr>
<td>5. The task(s) is/are contextualized; i.e., written in the G.R.A.S.P.S.</td>
<td>3 2 1</td>
</tr>
<tr>
<td>form.</td>
<td></td>
</tr>
<tr>
<td>6. The task effectively integrates two or more subject areas</td>
<td>3 2 1</td>
</tr>
<tr>
<td>7. The task includes criteria/rubric(s) targeting distinct traits of</td>
<td>3 2 1</td>
</tr>
<tr>
<td>understanding and successful performance based on the targeted</td>
<td></td>
</tr>
<tr>
<td>standard(s)/understanding(s); i.e., criteria do not simply focus on</td>
<td></td>
</tr>
<tr>
<td>surface features of a product or performance.</td>
<td></td>
</tr>
<tr>
<td>8. The task directions for students are clear.</td>
<td>3 2 1</td>
</tr>
<tr>
<td>Optional:</td>
<td></td>
</tr>
<tr>
<td>9. The task allows students to demonstrate their understanding/</td>
<td>3 2 1</td>
</tr>
<tr>
<td>proficiency with some appropriate choice/variety (e.g., of products</td>
<td></td>
</tr>
<tr>
<td>or performances).</td>
<td></td>
</tr>
<tr>
<td>10. The task incorporates appropriate use of technology.</td>
<td>3 2 1</td>
</tr>
</tbody>
</table>

Other: ___________________________________________________________________ 3 2 1