Unit 2: Energy (Energy)

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Title Section

Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

Science: Grade 4

Unit 2: Energy

Belleville Board of Education

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Unit Overview

Unit two provides detailed information about energy. The content within the unit focuses on discovering what energy is an how it is transferred. The transfer of energy requires speed which may result in a collision of energy. Collision changes energy in different ways.

Enduring Understanding

- Energy is the ability to cause change in matter.
- Humans use energy every day.
- Light, sound, heat, and motion are different forms of energy.
- All life on Earth depends on light and heat from the Sun.
- Heat is energy that transfers, or moves, between objects with different temperatures.
- Sound is energy that travels in vibrations.
- Motion energy is anything that is moving.
- The speed and weight of an object affect its energy.
- Sounds differ between soft and loud based on energy transfer.
- Energy transfer is a movement of energy from place to place or from one object to another.
- Energy transformation is a change in energy from one form to another.
- Radio waves, microwaves, and x-rays are energy waves that are not visible, but carry energy as they travel and spread out.
- Collisions happen when two objects bump into each other.

Essential Questions

- **What is energy?**
- **What are different forms of energy?**
- **How does energy cause change?**
- **How does energy change form?**

- **How is energy transferred?**
- **How does energy relate to loudness of a sound?**
- **How do collisions show energy?**

Exit Skills

By the end of Grade 4, Science Unit 2, the student should be able to:

- Ask questions and define problems
- Construct explanations and design solutions
- Define and delimit engineering problems
- Develop possible solutions
- Optimize the design solution
- Analyze the influence of science, engineering, and technology on society and the natural world

New Jersey Student Learning Standards (NJSLS-S) & NGSS

SEP - Planning and Carrying Out Investigations

SEP - Constructing Explanations and Designing Solutions

SEP - Asking Questions and Defining Problems

DCI - Definitions of Energy

DCI - Conservation of Energy and Energy Transfer

DCI - Relationship Between Energy and Forces

DCI - Energy in Chemical Processes and Everyday Life

DCI - Defining and Delimiting Engineering Problems

CCC - Energy and Matter

CCC - Influence of Science, Engineering, and Technology on Society and the Natural World

CCC - Science is a Human Endeavor

NextGen Science Standards

SCI.4-PS3-1	Use evidence to construct an explanation relating the speed of an object to the energy of that object.
SCI.4-PS3-3	Ask questions and predict outcomes about the changes in energy that occur when objects collide.
SCI.4-PS3-2	Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
SCI.4-PS3-4	Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

Interdisciplinary Connections

Do the Math! pp. 75, 106

MA.4.NBT.A.1	Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.
MA.4.MD.A.1	Know relative sizes of measurement units within one system of units including km, m, cm, mm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two column table.

Learning Objectives

In Unit 2, students will demonstrate the ability to:

HMH Science Dimensions, Unit 2 - Lesson 1:

- **Differentiate** between sound, light, heat, and motion energy
- **Evaluate** the importance of the sun's energy
- **Explain** how electrical energy is transferred

HMH Science Dimensions, Unit 2 - Lesson 2:

- **Distinguish** between light, sound, and heat energy transfers
- **Illustrate** the changes which result from energy transfers by providing evidence
- **Conclude** how energy relates to the loudness of a sound

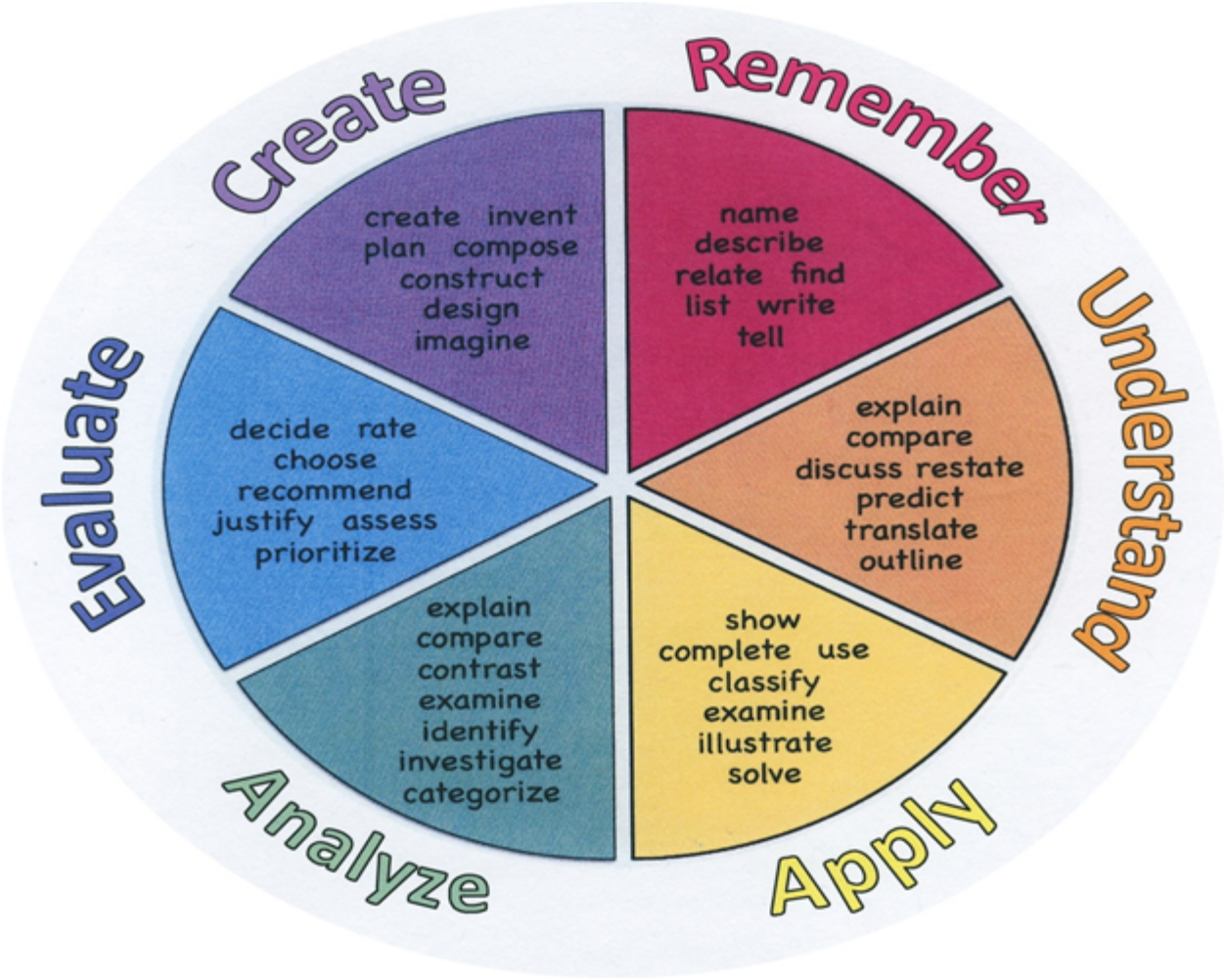
HMH Science Dimensions, Unit 2 - Lesson 3:

- **Generate** reasons to explain how energy changes when objects in motion collide
- **Infer** how weight and size can affect collisions
- **Analyze** the relationship between speed and energy through experiments

Below are examples of action verbs associated with each level of the Revised Bloom’s Taxonomy. These are

useful in writing learning objectives, assignment objectives and exam questions.

Remember	Understand	Apply	Analyze	Evaluate	Create
	Classify				
	Defend	Choose			
	Demonstrate	Dramatize			
	Distinguish	Explain			
	Explain	Generalize			Combine
Choose	Express	Judge	Categorize		Compose
Describe	Extend	Organize	Classify		Construct
Define	Give Examples	Paint	Compare	Appraise	Design
Label	Illustrate	Prepare	Differentiate	Judge	Develop
List	Indicate	Produce	Distinguish	Criticize	Formulate
Locate	Interrelate	Select	Identify	Defend	Hypothesize
Match	Interpret	Show	Infer	Compare	Invent
Memorize	Infer	Sketch	Point out	Assess	Make
Name	Match	Solve	Select	Conclude	Originate
Omit	Paraphrase	Use	Subdivide	Contrast	Organize
Recite	Represent	Add	Survey	Critique	Plan
Select	Restate	Calculate	Arrange	Determine	Produce
State	Rewrite	Change	Breakdown	Grade	Role Play
Count	Select	Classify	Combine	Justify	Drive
Draw	Show	Complete	Detect	Measure	Devise
Outline	Summarize	Compute	Diagram	Rank	Generate
Point	Tell	Discover	Discriminate	Rate	Integrate
Quote	Translate	Divide	Illustrate	Support	Prescribe
Recall	Associate	Examine	Outline	Test	Propose
Recognize	Compute	Graph	Point out		Reconstruct
Repeat	Convert	Interpolate	Separate		Revise
Reproduce	Discuss	Manipulate			Rewrite
	Estimate	Modify			Transform
	Extrapolate	Operate			
	Generalize	Subtract			
	Predict				



Suggested Activities & Best Practices

HMH Science Dimensions, Unit 2 - Lesson 1:

- **Engage:** "Can You Explain It?" lesson
- **Explore/Explain:** "Energy Is All Around?" and "Energy Transfer" lessons and hands-on activity (Exploration 1 & 2)
- **Elaborate:** "Discover More" extension activity
- **Evaluate:** "Lesson Check" and "Lesson Roundup" assessments (formative/summative)

HMH Science Dimensions, Unit 2 - Lesson 2:

- **Engage:** "Can You Explain It?" lesson
- **Explore/Explain:** "Heat," "Here Comes the Sun," and " Seeing Sound" lessons and hands-on activity (Exploration 1, 2, & 3)
- **Elaborate:** "Discover More" extension activity
- **Evaluate:** "Lesson Check" and "Lesson Roundup" assessments (formative/summative)

HMH Science Dimensions, Unit 2 - Lesson 3:

- **Engage:** "Can You Explain It?" lesson and hands-on activity
- **Explore/Explain:** "Things That Move Have Energy," "Wonderful Springs," and "Collisions" lessons and hands-on activity (Exploration 1, 2, & 3)
- **Elaborate:** "Discover More" extension activity
- **Evaluate:** "Lesson Check" and "Lesson Roundup" assessments (formative/summative)

HMH Science Dimensions, Unit 2 - Performance Task (Energy Transfers All Around):

- **Define Task**
- **Research**
- **Examine Data**
- **Plan**
- **Perform and Record**
- **Communicate**

HMH Science Dimensions, Unit 2 - Unit Project (Truck Pull):

- **Plan and Design**
- **Analyze Results**
- **Claims, Evidence, and Reasoning**

Assessment Evidence - Checking for Understanding (CFU)

- Admit Tickets
- Compare & Contrast
- Create a Multimedia Poster
- DBQ's
- Define

- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- HMH End-of-Year Test (Benchmark)
- HMH Mid-Year Test (Benchmark)
- HMH Performance-based Assessment (Alternative)
- Illustration
- Journals
- KWL Chart
- Learning Center Activities
- Multimedia Reports
- Outline
- Question Stems
- Quickwrite
- Quizzes (Formative)
- Red Light, Green Light
- Self- assessments
- Study Guide
- Surveys
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Unit review/Test prep
- Unit tests (Summative)
- Web-Based Assessments
- Written Reports

Primary Resources & Materials

HMH Science Dimensions: Teacher Edition, Student workbooks, online resources

HMH Equipment & Safety Kits

HMH Science Dimensions S&E Leveled Readers

- On Level: How do we Generate and Use Electricity?
- Extra Support: How do we Generate and Use Electricity?
- Enrichment: Energy on Demand: Making Electricity

Ancillary Resources

Science Weekly, Scholastic News, NewsELA, YouTube/TeacherTube, National Geographics Kids, Science Channel

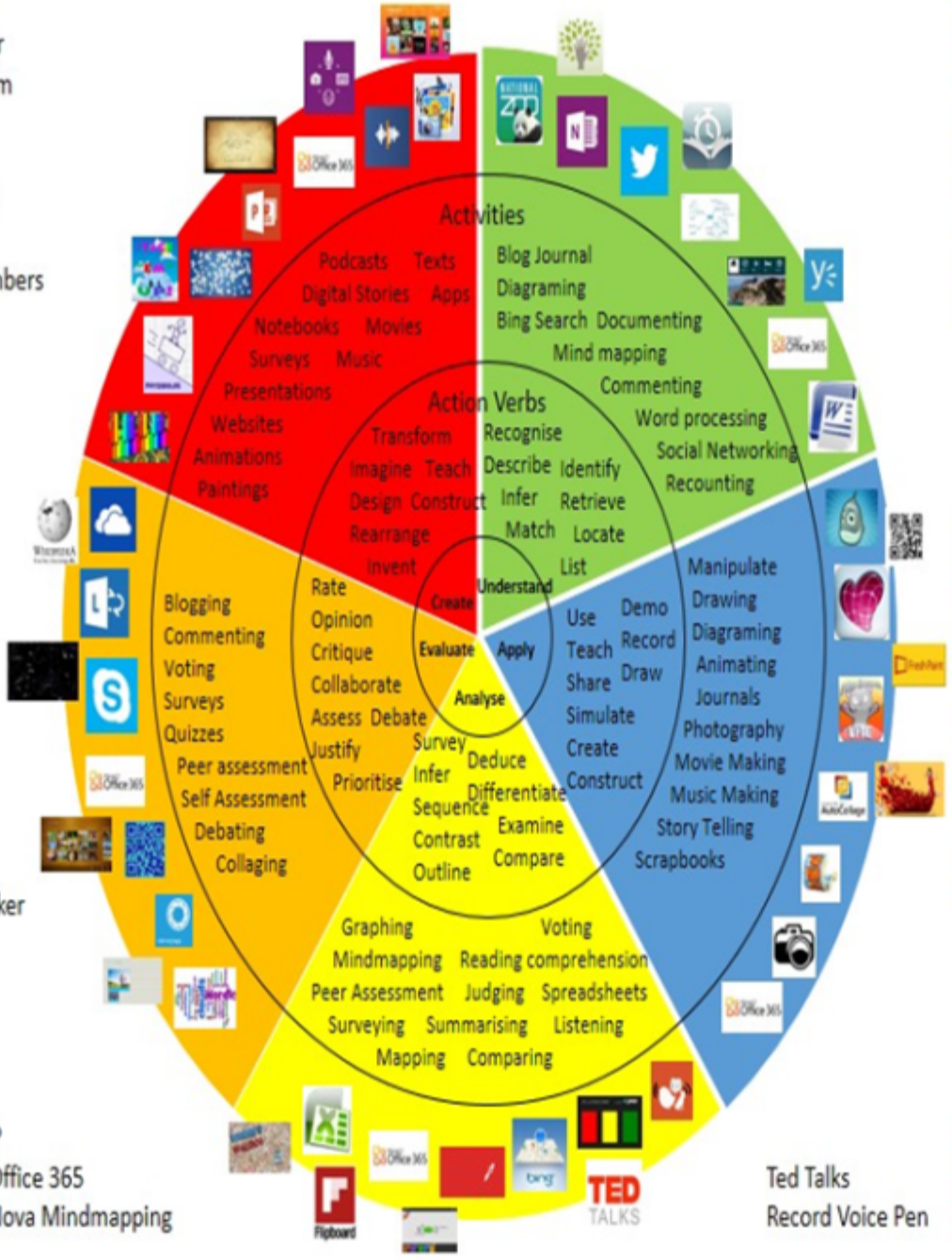
https://ngss-assessment.portal.concord.org/

Technology Infusion

Win 8.1 Apps/Tools Pedagogy Wheel

Podcasts
Photostory 3
Kid Story Builder
Music Maker Jam
Paint A Story
Office 365
MS PowerPoint
Stack 'Em Up
NqSquared Numbers
Physamajig
Xylophone 8

Wikipedia
Skydrive
Lync
SkyMap
Skype
Office 365
Puzzle Touch
Easy QR
Memorylage
Life Moments
Word Cloud Maker



Where's Waldo?
MS Excel Office 365
Flipboard Nova Mindmapping

Ted Talks
Record Voice Pen

Originally taken from http://www.coetail.com/vzimmer/files/2013/02/iPadagogy-Wheel.001.jpg
And adapted for Windows 8.1 devices by Charlotte Beckhurst @CharBeckhurst

Alignment to 21st Century Skills & Technology

Mastery and infusion of **21st Century Skills & Technology** and their Alignment to the core content areas is essential to student learning. The core content areas include:

- English Language Arts;
- Mathematics;
- Science and Scientific Inquiry (Next Generation);
- Social Studies, including American History, World History, Geography, Government and Civics, and Economics;
- World languages;
- Technology;
- Visual and Performing Arts.

CRP.K-12.CRP1.1	Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.
CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.
CRP.K-12.CRP5.1	Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.
CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

21st Century Skills/Interdisciplinary Themes

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

- ICT (Information, Communications and Technology) Literacy
- Information Literacy
- Life and Career Skills
- Media Literacy

21st Century Skills

- Civic Literacy
- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness
- Health Literacy

Differentiation

Differentiations:

- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions
- Use manipulatives
- Center-based instruction
- Token economy
- Study guides
- Teacher reads assessments allowed
- Scheduled breaks
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Story guides
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Large print edition
- Dictation to scribe

- Small group setting

Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Choice boards
- Games and tournaments
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Learning contracts
- Leveled rubrics
- Literature circles
- Multiple intelligence options
- Multiple texts
- Personal agendas
- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments
- Tiered products
- Varying organizers for instructions

Lo-Prep Differentiations

- Choice of books or activities
- Cubing activities
- Exploration by interest
- Flexible grouping
- Goal setting with students
- Jigsaw
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Reading buddies
- Varied journal prompts
- Varied supplemental materials

Special Education Learning (IEP's & 504's)

- printed copy of board work/notes provided
- additional time for skill mastery

- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- multi-sensory presentation
- multiple test sessions
- preferential seating
- preview of content, concepts, and vocabulary
- Provide modifications as dictated in the student's IEP/504 plan
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

English Language Learning (ELL)

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarif
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers

- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

At Risk

- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
- allowing students to select from given choices
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests
- using videos, illustrations, pictures, and drawings to explain or clarify

Talented and Gifted Learning (T&G)

- Above grade level placement option for qualified students
- Advanced problem-solving
- Allow students to work at a faster pace
- Cluster grouping
- Complete activities aligned with above grade level text using Benchmark results
- Create a blog or social media page about their unit
- Create a plan to solve an issue presented in the class or in a text
- Debate issues with research to support arguments
- Flexible skill grouping within a class or across grade level for rigor
- Higher order, critical & creative thinking skills, and discovery
- Multi-disciplinary unit and/or project
- Teacher-selected instructional strategies that are focused to provide challenge, engagement, and

growth opportunities

- Utilize exploratory connections to higher-grade concepts
- Utilize project-based learning for greater depth of knowledge