Science Curriculum

The Engineering Design Process

1. ASK
   - What are the Problems?
   - What are the Constraints?

2. IMAGINE
   - Brainstorm Ideas
   - Choose the Best One

3. PLAN
   - Draw a Diagram
   - Gather Needed Materials

4. CREATE
   - Follow the Plan
   - Test It Out!

5. IMPROVE
   - Discuss What Can Work Better
   - Repeat Steps 1-5 to Make Changes

Grade 3
Engineering & Design
Course Description

In unit one, students engage in an engineering challenge to develop habits of mind and classroom practices that will be reinforced throughout the school year. In unit two, students engage in four investigations dealing with big ideas in life science—plants and animals are organisms and exhibit a variety of strategies for life, organisms are complex and have a variety of observable structures and behaviors, organisms have varied but predictable life cycles and reproduce their own kind, and individual organisms have variations in their traits that may provide an advantage in surviving in the environment. Students observe, compare, categorize, and care for a selection of organisms. Students engage in science and engineering practices to investigate structures and behaviors of the organisms and learn how some of the structures function in growth and survival. Students look at the interactions between organisms of the same kind, among organisms of different kinds, and between the environment and populations over time. In unit three, students explore magnetism and gravity to look for patterns of motion to predict future motion. Students work with magnets and paper clips, wheel and-axle systems, paper air twirlers, and rotating tops. Students use their knowledge of science to enter the engineering design process and through the process refine their science understanding. Students use metric tools to refine observations by measuring mass and volume, they make mixtures and solutions to develop a foundational understanding of conservation of mass, and they observe a simple chemical reaction to extend their understanding of conservation. Students engage in science and engineering practices to collect data to answer questions, and to define problems in order to develop solutions. Students reflect on their own use of these practices and find out about how others use these practices in science and engineering careers. In unit four, students explore the properties of water, the water cycle and weather, interactions between water and other earth materials, and how humans use water as a natural resource. Students engage in science and engineering practices in the context of water, weather, and climate and explore the crosscutting concepts of patterns; cause and effect; scale, proportion, and quantity; and systems and system models. They are introduced to the nature of science, how science affects everyday life, and the influence of engineering, technology, and science on society and the natural world.
Teachers may choose from a variety of instructional approaches that are aligned with 3 dimensional learning to achieve this goal. These approaches include:

<table>
<thead>
<tr>
<th>Inquiry Kit Instruction (modified)</th>
<th>Challenge Based Instruction</th>
<th>5 E Instructional Model (BSCS)</th>
<th>Culturally Relevant Instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project-Based Instruction</td>
<td>Tinkering Pedagogy</td>
<td>Learning Progressions</td>
<td>Knowledge Integration</td>
</tr>
<tr>
<td>Model-based Reasoning</td>
<td>Place-based Instruction</td>
<td>Meaningful Expertise Instruction</td>
<td>Emergent Investigations (RSS)</td>
</tr>
</tbody>
</table>
Pacing Chart

This pacing chart is based upon 160 minutes of instruction per cycle.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Topic</th>
<th>Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit 1</td>
<td>Engineering &amp; Design</td>
<td>10</td>
</tr>
<tr>
<td>Unit 2</td>
<td>FOSS Structures of Life</td>
<td>40</td>
</tr>
<tr>
<td>Unit 3</td>
<td>FOSS Motion &amp; Matter</td>
<td>40</td>
</tr>
<tr>
<td>Unit 4</td>
<td>Earth’s Weather &amp; Climate</td>
<td>30</td>
</tr>
</tbody>
</table>

Unit Summary

This unit introduces students to the engineering design process and scientific practices that will foster a strong, collaborative classroom learning community throughout the year. Students will be introduced to interactive notebooking in science as a learning tool that will be used consistently to record their thinking, observations of phenomena and outcomes of experiments and design challenges. Students have the opportunity to act as engineers, engaging in the design process to solve a problem.

Student Learning Objectives

<table>
<thead>
<tr>
<th>Objective</th>
<th>Code</th>
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</thead>
<tbody>
<tr>
<td>Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)</td>
<td></td>
</tr>
<tr>
<td>Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. (3-5-ETS1-2)</td>
<td></td>
</tr>
<tr>
<td>Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved. (3-5-ETS1-3)</td>
<td></td>
</tr>
</tbody>
</table>

Unit Sequence
## Part A Storyline

Engineers are people who work to solve problems and design solutions. Mr. Fookwire has a problem in his garden. How does he behave like an engineer?

### Essential Question: What do we do when an idea doesn’t seem to work?

<table>
<thead>
<tr>
<th>Concepts</th>
<th>Formative Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Asking questions and defining problems in 3–5 builds on grades K–2</td>
<td>Students who understand the concepts are able to:</td>
</tr>
<tr>
<td>experiences and progresses to specifying qualitative relationships.</td>
<td>- Ask questions and define problems based off of experiences</td>
</tr>
<tr>
<td>● Planning and carrying out investigations to answer questions or test</td>
<td>- Be able to plan and design a test for solutions while staying within the limits</td>
</tr>
<tr>
<td>solutions to problems in 3–5 builds on K–2 experiences and progresses</td>
<td>of restrictions that were given to them.</td>
</tr>
<tr>
<td>to include investigations that control variables and provide</td>
<td>- Brainstorm and develop ideas from individual and group think</td>
</tr>
<tr>
<td>evidence to support explanations or design solutions.</td>
<td>- Evaluated and identify faults in design that do successfully meet criteria for</td>
</tr>
<tr>
<td></td>
<td>the task at hand.</td>
</tr>
</tbody>
</table>

### Learning Objective and Standard

**Students will become familiar with the work of engineers and describe their role in society.** Develop expository writing through notebooking.

*Foundational to 3-5-ETS1-1*

**Students will identify a problem that can be solved through**

<table>
<thead>
<tr>
<th>Essential Questions</th>
<th>Content Related to DCI</th>
<th>Sample Activities</th>
<th>Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>What do engineers do? How do scientists and engineers record their thinking??</td>
<td>● Possible solutions to a problem are limited by available materials and resources</td>
<td>Complete first entry in the Science notebook, including the setup of Table of</td>
<td>Science Notebook - See Resource Folder</td>
</tr>
<tr>
<td></td>
<td>(constraints). The success of a designed solution is determined by considering the</td>
<td>Contents.</td>
<td>What Do Engineers Do? probe - See Resource</td>
</tr>
<tr>
<td></td>
<td>desired features of a solution (criteria). Different proposals for solutions</td>
<td>Complete What Do Engineers Do? probe.</td>
<td>Folder</td>
</tr>
<tr>
<td></td>
<td>can be compared on the basis of how well each one meets the specified criteria for</td>
<td>Watch What is Engineering? video and record evidence in science notebook.</td>
<td>Books about engineers - See Resource Folder</td>
</tr>
<tr>
<td></td>
<td>success or how well each takes the constraints into account.</td>
<td>Design a cover to the science notebook based on prior knowledge about science</td>
<td>An Engineer is Someone Who - See Resource</td>
</tr>
<tr>
<td></td>
<td></td>
<td>and engineering.</td>
<td>Folder</td>
</tr>
<tr>
<td>What problem does Mr. Fookwire have? How does he</td>
<td>Read the book Those Darn Squirrels! by Adam Rubin.</td>
<td></td>
<td>Those Darn Squirrels Lesson Plan – See</td>
</tr>
<tr>
<td>Grade 3 Unit 1: Engineering &amp; Design</td>
<td>Instructional Days: 10</td>
<td></td>
<td></td>
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<tr>
<td>------------------------------------</td>
<td>------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>engineering.</strong></td>
<td><strong>3-5-ETS1-1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>behave like an engineer?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As a class, discuss what problem Mr. Mr. Fookwire is having in the story. Record in Science Notebook.</td>
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<td></td>
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</tr>
<tr>
<td>Discuss evidence from the story regarding how Mr. Mr. Fookwire behaves like an engineer, as well as when he did not act like an engineer. Create T chart. Record in Science Notebook.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use text dependent questions to explore the problem. Record in Science Notebook.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Create the Engineering Design Process anchor chart. Look for evidence in the text of characters using this process to solve their problem. Record in Science Notebook.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Students will use evidence from the text to further develop their understanding of the problem. | **3-5-ETS1-1** |
| What evidence from the text can we use to gain a better understanding of Mr. Fookwire’s problem? | |
| Use text dependent questions to explore the problem. Record in Science Notebook. |

| Students will identify instances where the engineering design process was used by characters in the story. | **3-5-ETS1-1** |
| Do engineers have a specific way that they work to solve problems? Did Mr. Fookwire or the squirrels use this process? | |
| Create the Engineering Design Process anchor chart. Look for evidence in the text of characters using this process to solve their problem. Record in Science Notebook. |

**Resource Folder**

- *Those Darn Squirrels* read aloud video - See Resource Folder
- Design Process - See Resource Folder
- *Those Darn Squirrels* text dependent questions notebook master - See Resource Folder
- *Those Darn Squirrels* chart notebook master - See Resource Folder
- *Those Darn Squirrels* final questions notebook master - See Resource Folder

**Paterson Public Schools**

Preparing All Children for College and Career
Part B Storyline: Sir Houndstooth III is stuck on a deserted island. Help him escape using your engineering skills.

**Essential Question:** How can we use the design process to solve a challenge?

<table>
<thead>
<tr>
<th>Concepts</th>
<th>Formative Assessment</th>
</tr>
</thead>
</table>
| ● Asking questions and defining problems in 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.  
● Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. | Students who understand the concepts are able to:  
• Ask questions and define problems based off of experiences  
• Be able to plan and design a test for solutions while staying within the limits of restrictions that were given to them.  
• Brainstorm and develop ideas from individual and group think  
• Evaluated and identify faults in design that do successfully meet criteria for the task at hand. |

<table>
<thead>
<tr>
<th>Learning Objective and Standard</th>
<th>Essential Questions</th>
<th>Content Related To DCI</th>
<th>Sample Activities</th>
<th>Resources</th>
</tr>
</thead>
</table>
| Students will define the problem and identify any constraints.  
3-5 ETS1-1 | What is the problem that we are facing? What constraints are there to take into consideration? | • Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. | Read story of Shipwrecked passenger—Sir Bloodhound III to students. Challenge 1: Island Architect: Construct A Hut.  
As a class, discuss what problem Mr. Bloodhound III is having in the story. Students should clearly define Sir Bloodhound’s problem and any constraints he faces in their Science notebooks. | Story in Resource Folder |
<table>
<thead>
<tr>
<th>Students will brainstorm a solution to their problem and develop a plan to create their prototype. 3-5 ETS1-2</th>
<th>How many solutions can we generate for the same problem? How can we plan to create a prototype of our chosen solution?</th>
<th>• At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.</th>
<th>Brainstorm ideas in science notebook and exchange ideas with their peers. Plan design in the science notebook. Students must draw a plan for their HUTS before they are given access to materials to create their prototype. List materials needed. Differentiation - Students can use flashcards with pictures and names and glue it into their notebook. See STEAM Materials in resource folder.</th>
<th>Notebook Masters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students will test their prototypes and compare the merits of various designs. 3-5 ETS-3</td>
<td>What are some of the advantageous features of each prototype? What final adjustments would you make to your prototype based upon your tests?</td>
<td>• Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. • Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.</td>
<td>Students will test their prototypes. Ensure that the students engage in a fair test of their models. Students should record results of the test in their Science Notebook. Follow the same process challenges 2-5.</td>
<td>Rubric for testing</td>
</tr>
</tbody>
</table>

**Important teacher note:** this is not a competitive exercise, so it is important to emphasize the best parts of each model: some may use less materials, others may be stronger, etc. DO NOT identify a model as “best” or “worst”. Celebrate completion of design challenge with engineering awards.

Award template - See Resource Folder
This unit introduces the engineering design process and supports practices that will build a strong collaborative learning community for the year. The teacher uses a read aloud to introduce a design problem. Students identify the problem, empathize with the person who has the problem and use the engineering design process to develop and refine a solution to it. They are encouraged to think that there are many possible solutions to a problem and do not look for one “correct” answer. They engage in class discussions and partner shares to build on and refine their ideas. Students begin to develop the habit of using a scientific notebook during this time.

Students will participate in tasks that will require them to work with restrictions and limitations. Student’s notebooks should show evidence of brainstorming, group thinking and changes in their designs and thinking. It should also show evidence of the manner in which a fair test was conducted of the prototypes.

**Modifications for differentiation at all levels**

*Teacher Note: Teachers identify the modifications that they will use in the unit.*

Restructure lesson using UDL principles ([http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA](http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA))

- Structure lessons around questions that are authentic, relate to students’ interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide ELL students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities.
Interdisciplinary Connections

E.L.A
- RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (3-5-ETS1-2)
- W.5.7 Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (3-5-ETS1-1),(3-5-ETS1-3)
- W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (3-5-ETS1-1),(3-5-ETS1-3)
- W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (3-5-ETS1-1),(3-5-ETS1-3)

Mathematics –
- MP.2 Reason abstractly and quantitatively. (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3)
- MP.4 Model with mathematics. (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3)
- MP.5 Use appropriate tools strategically. (3-5-ETS1-1),(3-5-ETS1-2)

Vocabulary

<table>
<thead>
<tr>
<th>Design</th>
<th>Brainstorm</th>
<th>Testing</th>
<th>Restrictions</th>
<th>Cleverest</th>
<th>Constraints</th>
<th>Prototype</th>
<th>Evaluate</th>
<th>Geniuses</th>
<th>Stockpile</th>
<th>Devised</th>
</tr>
</thead>
</table>

Educational Technology Standards

8.1.8.A.1, 8.1.8.B.1, 8.1.8.C.1, 8.1.8.D.1, 8.1.8.E.1, 8.1.8.F.1

Technology Operations and Concepts

- Create professional documents (e.g., newsletter, personalized learning plan, business letter or flyer) using advanced features of a word processing program.

**Example:** Create a brochure to advertise your levee design.

Creativity and Innovation
Grade 3 Unit 1: Engineering & Design

Instructional Days: 10

- Synthesize and publish information about a local or global issue or event on a collaborative, web-based service.
  
  **Example:** Publish a blog regarding hurricane preparedness.

**Communication and Collaboration**

- Participate in an online learning community with learners from other countries to understand their perspectives on a global problem or issue, and propose possible solutions.
  
  **Example:** Use empatico.org to collaborate with students from other countries who have experienced hurricanes.

**Digital Citizenship**

- Model appropriate online behaviors related to cyber safety, cyber bullying, cyber security, and cyber ethics.
  
  **Example:** Use Diigo.com to have a monitored and appropriate online conversation about an article.

**Research and Information Literacy**

- Gather and analyze findings using data collection technology to produce a possible solution for a content-related or real-world problem.
  
  **Example:** Use NOAA or AMS websites to gather data about hurricane frequency, location, etc.

**Critical Thinking, Problem Solving, Decision Making**

- Use an electronic authoring tool in collaboration with learners from other countries to evaluate and summarize the perspectives of other cultures about a current event or contemporary figure.
  
  **Example:** Utilize Voicethread to create a narrative account of a hurricane event.

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**Career Ready Practices**

Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

**CRP1. Act as a responsible and contributing citizen and employee**

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.

**Example:** Participate as an active an ethical member of class discussions and projects. Teacher can explore how decision making and behaviors can impact the broader community in specific science related examples, such as limiting littering, choosing to recycle, etc.

### CRP4. Communicate clearly and effectively and with reason.

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.

**Example:** Students can develop and present well supported arguments via short presentations, during group work and gallery walks.

### CRP5. Consider the environmental, social and economic impacts of decisions.

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.

**Example:** Participate as an active an ethical member of class discussions and projects. Teacher can explore how decision making and behaviors can impact the broader community in specific science related examples, such as limiting littering, choosing to recycle, etc.

### CRP6. Demonstrate creativity and innovation.

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.

**Example:** Engineering tasks provide many opportunities for student to use creative and innovative approaches.

### CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the
problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

**Example:** Gather evidence to support a claim and identify reasoning that is being applied.

**CRP11. Use technology to enhance productivity.**

Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks—personal and organizational—of technology applications, and they take actions to prevent or mitigate these risks.

**Example:** Utilize Google Apps for Education suite to access and complete assignments. The teacher can use Google Classroom to identify age and subject appropriate resource materials that can be linked directly. A variety of apps or web based platforms (Tellagami, PowToons, Glogster, Padlet) can be used to generate multimedia content.

**CRP12. Work productively in teams while using cultural global competence.**

Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

**Example:** Students must be given regular opportunities to work with groups in a variety of settings for discussion, projects, etc.
### WIDA Proficiency Levels

At the given level of English language proficiency, English language learners will process, understand, produce or use:

<table>
<thead>
<tr>
<th>Level</th>
<th>Examples</th>
</tr>
</thead>
</table>
| 6- Reaching | - Specialized or technical language reflective of the content areas at grade level  
               - A variety of sentence lengths of varying linguistic complexity in extended oral or written discourse as required by the specified grade level  
               - Oral or written communication in English comparable to proficient English peers                      |
| 5- Bridging | - Specialized or technical language of the content areas  
               - A variety of sentence lengths of varying linguistic complexity in extended oral or written discourse, including stories, essays or reports  
               - Oral or written language approaching comparability to that of proficient English peers when presented with grade level material.                       |
| 4- Expanding| - Specific and some technical language of the content areas  
               - A variety of sentence lengths of varying linguistic complexity in oral discourse or multiple, related sentences or paragraphs  
               - Oral or written language with minimal phonological, syntactic or semantic errors that may impede the communication, but retain much of its meaning, when presented with oral or written connected discourse, with sensory, graphic or interactive support |
| 3- Developing| - General and some specific language of the content areas  
               - Expanded sentences in oral interaction or written paragraphs  
               - Oral or written language with phonological, syntactic or semantic errors that may impede the communication, but retain much of its meaning, when presented with oral or written, narrative or expository descriptions with sensory, graphic or interactive support |
| 2- Beginning | - General language related to the content area  
               - Phrases or short sentences  
               - Oral or written language with phonological, syntactic, or semantic errors that often impede of the communication when presented with one to multiple-step commands, directions, or a series of statements with sensory, graphic or interactive support |
| 1- Entering | - Pictorial or graphic representation of the language of the content areas  
               - Words, phrases or chunks of language when presented with one-step commands directions, WH-, choice or yes/no questions, or statements with sensory, graphic or interactive support |
### Language Development Supports For English Language Learners

**To Increase Comprehension and Communication Skills**

#### Environment

- Welcoming and stress-free
- Respectful of linguistic and cultural diversity
- Honors students’ background knowledge
- Sets clear and high expectations
- Includes routines and norms
- Is thinking-focused vs. answer-seeking
- Offers multiple modalities to engage in content learning and to demonstrate understanding
- Includes explicit instruction of specific language targets
- Provides participation techniques to include all learners
- Integrates learning centers and games in a meaningful way
- Provides opportunities to practice and refine receptive and productive skills in English as a new language
- Integrates meaning and purposeful tasks/activities that:
  - Are accessible by all students through multiple entry points
  - Are relevant to students' lives and cultural experiences
  - Build on prior mathematical learning
  - Demonstrate high cognitive demand
  - Offer multiple strategies for solutions
  - Allow for a language learning experience in addition to content

#### Sensory Supports*

- Real-life objects (realia) or concrete objects
- Physical models
- Manipulatives
- Pictures & photographs
- Visual representations or models such as diagrams or drawings
- Videos & films
- Newspapers or magazines
- Gestures
- Physical movements
- Music & songs

#### Graphic Supports*

- Graphs
- Charts
- Timelines
- Number lines
- Graphic organizers
- Graphing paper

#### Interactive Supports*

- In a whole group
- In a small group
- With a partner such as Turn-and-Talk
- In pairs as a group (first, two pairs work independently, then they form a group of four)
- In triads
- Cooperative learning structures such as Think-Pair-Share
- Interactive websites or software
- With a mentor or coach

#### Verbal and Textual Supports

- Labeling
- Students’ native language
- Modeling
- Repetitions
- Paraphrasing
- Summarizing
- Guiding questions
- Clarifying questions
- Probing questions
- Leveled questions such as What? When? Where? How? Why?
- Questioning prompts & cues
- Word Banks
- Sentence starters
- Sentence frames
- Discussion frames
- Talk moves, including Wait Time

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BUILDING EQUITY IN YOUR TEACHING PRACTICE

How do the essential questions highlight the connection between the big ideas of the unit and equity in your teaching practice?

CONTENT INTEGRATION
Teachers use examples and content from a variety of cultures & groups.

This unit/lesson is connected to other topics explored with students.

There are multiple viewpoints reflected in the content of this unit/lesson.

The materials and resources are reflective of the diverse identities and experiences of students.

The content affirms students, as well as exposes them to experiences other than their own.

KNOWLEDGE CONSTRUCTION
Teachers help students understand how knowledge is created and influenced by cultural assumptions, perspectives & biases.

This unit/lesson provides context to the history of privilege and oppression.

This unit/lesson addresses power relationships.

This unit/lesson helps students to develop research and critical thinking skills.

This curriculum creates windows and mirrors* for students.

PREJUDICE REDUCTION
Teachers implement lessons and activities to assert positive images of ethnic groups & improve intergroup relations.

This unit/lesson helps students question and unpack biases & stereotypes.

This unit/lesson helps students examine, research and question information and sources.

The curriculum encourages discussion and understanding about the groups of people being represented.

This unit/lesson challenges dominant perspectives.

EQUITABLE PEDAGOGY
Teachers modify techniques and methods to facilitate the academic achievement of students from diverse backgrounds.

The instruction has been modified to meet the needs of each student.

Students feel respected and their cultural identities are valued.

Additional supports have been provided for students to become successful and independent learners.

Opportunities are provided for student to reflect on their learning and provide feedback.

EMPOWERING SCHOOL CULTURE
Using the other four dimensions to create a safe and healthy educational environment for all.

There are opportunities for students to connect with the community.

My classroom is welcoming and supportive for all students.

I am aware of and sensitive to the needs of my students and their families.

There are effective parent communication systems established. Parents can talk to me about issues as they arise in my classroom.

Paterson Public Schools
Preparing All Children for College and Career

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### Culturally Relevant Pedagogy Examples

- **Everyone has a Voice:** Create a classroom environment where students know that their contributions are expected and valued.  
  **Example:** Norms for sharing are established that communicate a growth mindset for mathematics. All students are capable of expressing mathematical thinking and contributing to the classroom community. Students learn new ways of looking at problem solving by working with and listening to each other.

- **Run Problem Based Learning Scenarios:** Encourage scientifically productive discourse among students by presenting problems that are relevant to them, the school and/or the community.  
  **Example:** Using a Place Based Education (PBE) model, students explore science concepts while determining ways to address problems that are pertinent to their neighborhood, school or culture.

- **Encourage Student Leadership:** Create an avenue for students to propose problem solving strategies and potential projects.  
  **Example:** Students can deepen their understanding of engineering criteria and constraints by creating design challenges together and deciding if the problems fit the necessary criteria. This experience will allow students to discuss and explore their current level of understanding by applying the concepts to relevant real-life experiences.

- **Present New Concepts Using Student Vocabulary:** Use student diction to capture attention and build understanding before using academic terms.  
  **Example:** Teach science vocabulary in various modalities for students to remember. Use multi-modal activities, analogies, realia, visual cues, graphic representations, gestures, pictures and cognates. Directly explain and model the idea of vocabulary words having multiple meanings. Students can create the Word Wall with their definitions and examples to foster ownership.
**APPENDIX F – Science and Engineering Practices in the NGSS**

### Science and Engineering Practices

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

<table>
<thead>
<tr>
<th>Science and Engineering Practices</th>
<th>Disciplinary Core Ideas</th>
<th>Crosscutting Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Asking Questions and Defining Problems</strong></td>
<td><strong>ETS1.A: Defining and Delimiting Engineering Problems</strong></td>
<td><strong>Influence of Engineering, Technology, and Science on Society and the Natural World</strong></td>
</tr>
<tr>
<td>- Asking questions and defining problems in 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.</td>
<td>- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5-ETS1-1)</td>
<td>- People’s needs and wants change over time, as do their demands for new and improved technologies. (3-5-ETS1-1)</td>
</tr>
<tr>
<td>- Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)</td>
<td>- <strong>ETS1.B: Developing Possible Solutions</strong></td>
<td>- Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5-ETS1-2)</td>
</tr>
<tr>
<td><strong>Planning and Carrying Out Investigations</strong></td>
<td>- Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5-ETS1-2)</td>
<td>- At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5-ETS1-2)</td>
</tr>
<tr>
<td>- Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.</td>
<td>- At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5-ETS1-2)</td>
<td>- Tests are often designed to identify failure points or difficulties, which suggest the</td>
</tr>
<tr>
<td>- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3-5-ETS1-3)</td>
<td>- Tests are often designed to identify failure points or difficulties, which suggest the</td>
<td></td>
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</tbody>
</table>

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**Hamden Public Schools**

*Preparing All Children for College and Career*
Grade 3 Unit 1: Engineering & Design

Instructional Days: 10

<table>
<thead>
<tr>
<th>Constructing Explanations and Designing Solutions</th>
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</thead>
<tbody>
<tr>
<td>● Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.</td>
</tr>
<tr>
<td>● Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3-5-ETS1-2)</td>
</tr>
</tbody>
</table>

| Elements of the design that need to be improved. (3-5-ETS1-3) |

<table>
<thead>
<tr>
<th>ETS1.C: Optimizing the Design Solution</th>
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<tbody>
<tr>
<td>● Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5-ETS1-3)</td>
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</table>

<table>
<thead>
<tr>
<th>English Language Arts</th>
<th>Mathematics</th>
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<tbody>
<tr>
<td>ELA/Literacy – RI.5.1 Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (3-5-ETS1-2)</td>
<td>Mathematics – MP.2 Reason abstractly and quantitatively. (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3)</td>
</tr>
<tr>
<td>RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (3-5-ETS1-2)</td>
<td>MP.4 Model with mathematics. (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3)</td>
</tr>
<tr>
<td>RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeable. (3-5-ETS1-2)</td>
<td>MP.5 Use appropriate tools strategically. (3-5-ETS1-1),(3-5-ETS1-2),(3-5-ETS1-3)</td>
</tr>
<tr>
<td>W.5.7 Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (3-5-ETS1-1),(3-5-ETS1-3)</td>
<td>OA Operations and Algebraic Thinking (3-5-ETS1-1),(3-5-ETS1-2)</td>
</tr>
<tr>
<td>W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (3-5-</td>
<td></td>
</tr>
<tr>
<td>ETS1-1),(3-5-ETS1-3)</td>
<td>W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (3-5-ETS1-1),(3-5-ETS1-3)</td>
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</tbody>
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**Suggested Field Trips**

- Liberty Science Center, New York Hall of Science