Unit 1: Engineering and Technology

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Title Section

Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

Science, GRADE K

Unit 1: Engineering and Technology

Belleville Board of Education

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Unit Overview

In this unit, children will:

- define a simple problem that can be solved by developing a new or improved tool
- ask questions, make observations, and gather information helpful in thinking about a problem
- create a model based on evidence to represent a tool that solves a problem
- compare and test design solutions to a problem
- use sketches and modles to communicate a solution to a problem

Performance Expectations:

- ETS1-1 Ask questions, make observation, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as need to solve a given problem.
- ETS1-3 Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

Unit Vocabulary:

1. problem
2. solution
3. engineer
4. technology
5. design process

6. model

Unit Project: Design a Coin Sorter

Lesosn 1: Engineer It- What Does an Engineer Do?

Lesson 2: Engineer It- How Can We Use a Design Process?

Enduring Understanding

- A problem is something that needs to be fixed or made better.
- A problem may have many solutions.
- A solution is something that helps fix a problem.
- An engineer uses math and science to help solve problems.
- Technology is what engineers make and use to solve problems.
- Engineering is the process of designing new or improved technology.
- A design process is a set of five steps that engineers follow to solve problems.
- Step 1: Define a problem.
- Step 2: Plan and build.
- Step 3: Test and improve.
- Step 4: Redesign.
- Step 5: Communicate

Essential Questions

Lesson 1:

- What does an engineer do?

Lesson 2:

- How can we use a design process?

Unit Project:

- Have you ever mixed up a pile of coins?
- What can you make to help sort the coins?
- What are some ways to sort coins?
- What evidence can be collected to show that a coin sorter works as planned?
- How is the design of a coin sorter related to what you intend it to do?

Exit Skills

By the end of Grade K Unit 1, the student should be able to:

- tell how an engineer defines problems and comes up with solutions
- use a design process to define and solve a problem

New Jersey Student Learning Standards (NJSLS-S)

SCI.K-2-ETS1-3	Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.
SCI.K-2-ETS1-1	Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
SCI.K-2-ETS1-2	Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

Interdisciplinary Connections

Math

Language Arts

LA.W.K.6	With guidance and support from adults, explore a variety of digital tools to produce and publish writing, including in collaboration with peers.
LA.W.K.8	With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.
MA.K.MD.A.2	Directly compare two objects with a measurable attribute in common, to see which object has “more of”/“less of” the attribute, and describe the difference.

Learning Objectives

Lesson 1:

- SWDAT identify engineers as workers who find solutions to problems.

Hands-On Activity 1: SWDAT determine the problem and design a solution, by asking questions.

Lesson 2:

- SWDAT analyze a situation to solve a problem.

Hands-On Activity 2: SWDAT develop, test, modify, and compare tools that solve a problem.

You Solve It:

- SWDAT create the fastest race car possible using the design elements of a race car.
- SWDAT test the design to determine if it works as intended.

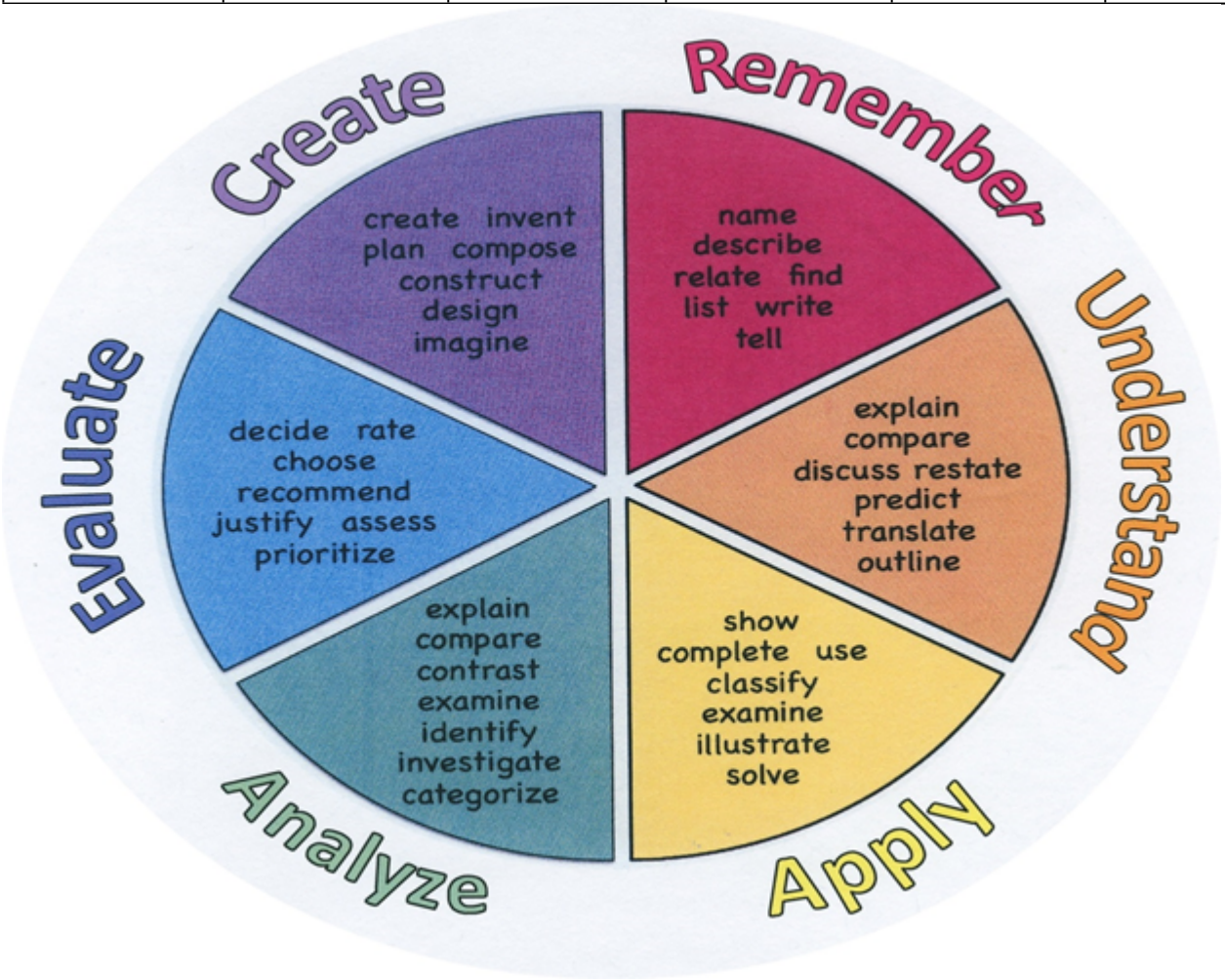
Unit Project:

- SWDAT develop a new or improved coin sorter.
- SWDAT test the design to determine if it works as intended.

Action Verbs: Below are examples of action verbs associated with each level of the Revised Bloom's Taxonomy.

Remember	Understand	Apply	Analyze	Evaluate	Create
Choose	Classify	Choose	Categorize	Appraise	Combine
Describe	Defend	Dramatize	Classify	Judge	Compose
Define	Demonstrate	Explain	Compare	Criticize	Construct

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



Suggested Activities & Best Practices

Vocabulary Game - Draw the Word!

Hands-On Activites - Problem and Solution; A Design Process

You Solve It Virtual Lab - Off to the Races!

Unit Project - Design a Coin Sorter

Performance Tast - Build an Airplane

Take it Further - People in Scienc and Engineering: Dr. Ayanna Howard

Assessments

- Pre-Assessment
- Formative: interactive workbook, apply what you know, lesson check/self check
- Summative: assessment guide, lesson quizes, unit test
- Online Assessment

Evidence of Student Learning - Checking for Understanding (CFU)

- Admit Tickets
- Anticipation Guide
- Common benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Newspaper Headline
- Outline
- Question Stems
- Quickwrite
- Quizzes

- Red Light, Green Light
- Self- assessments
- Socratic Seminar
- Study Guide
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit tests

Primary Resources & Materials

HMH Science Dimensions- Teacher Edition, Student workbook, online resources (including professional development videos)

HMH Online Handbook

Equipment Kits

Safety Kit

HMH Science Dimensions leveled readers

Ancillary Resources

online resources

Science Weekly

Scholastic News

National Geographic Kids

Technology Infusion

HMH Science Dimensions digital component

Computer based assessments

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.

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

Leveled Readers (On Level, Extra Support, Enrichment)

Reinforce Vocabulary- Help students connect vocabulary to real world examples.

RTI/Extra Support- Provide additional opportunites for hands-on discovery.

Extension Activity for enrichment

ELL- Provide hands-on examples of important concepts (ELL support resources include a glossary in English and Level Readers in Spanish and English)

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

Intervention Strategies

- 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

Special Education Learning

- 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
- multiple test sessions
- multi-sensory presentation
- preferential seating
- preview of content, concepts, and vocabulary
- 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

Sample Lesson

Unit Name: Engineering and Technology

NGSS: Engineering Design: K-2-ETS1-1; ETS1-2

Interdisciplinary Connection: Math K.G.A.2

Statement of Objective: SWDAT compare designs in terms of how their shape and stability address the problem of a desk covered with different things.

Anticipatory Set/Do Now: Begin with a discussion about the design process. Explain that the following steps in the design process may help solve the problem. Ask students to describe the problem. (the desk is very crowded)

Learning Activity: Ask: Suppose there were one more thing to put on the desk. What would be the problem? (there is no space for everything) Plan and build a model. Follow the steps of the design process to create a solution to the problem. Use the online handbook for tips on how to follow the design process in order to come up with the best solution to the problem. Students will also complete the "Do the Math!" activity and the apply what you know portion of their evidence notebook. When the students reach step 3 (test and improve), they will test their designs and then make any necessary improvements.

Student Assessment/CFU's: "Do the Math" activity; "Apply What You Know" in Evidence Notebook; teacher observation

Materials: SMART TV/SMARTBoard, HMH Science Dimensions workbook, evidence notebook and online resources

21st Century Themes and Skills: Collaboration, Communication

Differentiation/Modifications: use online handbook, visuals, small group assistance

Integration of Technology: explore the design process online using HMH Science Dimensions Resources, online handbook