

Winslow Township School District

Grade 8 Science

Unit 2: Engineering Design Process

Overview: This unit covers the skills that scientists and engineers need to be successful (scientific inquiry, measurement and the engineering design process), while building a classroom community to facilitate collaboration and learning for the year. Students will continue using interactive notebooking in science as a learning tool and the development of an Engineer’s Portfolio. Academic Skills include team building, collaborating, modeling and prototyping.

Overview	Standards for Science	Unit Focus	Essential Questions
Unit 2 Engineering Design Process	<ul style="list-style-type: none"> • MS-ETS1-1 • MS-ETS1-3 • MS-ETS1-4 • WIDA 4 	<ul style="list-style-type: none"> • Engineering • NJSLA-S Test Preparation 	<ul style="list-style-type: none"> • How can the engineering process fix a problem? • How can we use data to influence our redesign? • How do engineers use MakerSpaces and workshops to produce models and prototypes? • How can students prepare for the NJSLA-S Assessment?
<i>Unit 2: Enduring Understandings</i>	<ul style="list-style-type: none"> • Students will answer the question” How do we talk and work together like engineers”? • Students will assume responsibility for continual self-improvement and develop a model and prototype using the engineering design process • Students will make modifications to their prototype using steps 4 and 5 of the engineer’s design process. • Students utilize the MakerSpace for building and revising models and prototypes that were designed using the Engineer’s Design Process. • Understand how a 3-D Printer works and recognize the key components necessary to design and create an object using the 3-D printer. • Use the NJSLA-S practice test to prepare for the upcoming test. 		

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Curriculum Unit 2	Standards		Pacing	
			Days	Unit Days
Unit 2: Engineering Design Process	MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.	2	8
	MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.	2	
	MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.	2	
	Assessment, Re-teach and Extension		2	

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Disciplinary Core Ideas	Indicator #	Indicator
<p>ETS1.A: Defining and Delimiting Engineering Problems The more precisely a design task’s criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. (MS-ETS1-1)</p> <p>ETS1.B: Developing Possible Solutions A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4)</p> <p>ETS1.C: Optimizing the Design Solution Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. (MS-ETS1-3)</p>	MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
	MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
	MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

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Assessment Plan

<ul style="list-style-type: none"> • Exploratory activities • Warm-up activities • Individual/Group Lab report • Class discussions • Engineer’s Design Rubric • Teacher-created design Challenges 	<ul style="list-style-type: none"> • Quizzes • Tests • Google Suite for Education Assessment Tools (Google Docs, Google Slides) • Engineer’s Model/Prototype • 3-D printed object
Resources	Activities
<ul style="list-style-type: none"> • Chromebooks • Interactive notebooks • Science World • Compound Light and Digital microscopes • Virtual Labs • Edpuzzle • BrainPOP • Discover design: http://www.discoverdesign.org/design/process • Science buddies: http://www.sciencebuddies.org/engineering-design-process/engineering-design-process-steps.shtml • Template located in the Science Curriculum Folder→Design Process • The Engineering Design Process https://www.teachengineering.org/K12Engineering/DesignProces • What’s Great about Engineering Videos http://pbskids.org/designsquad/parentseducators/workshop/engineering.htm NJSLA Practice Test • Design Challenges: Resources and challenges are located in the Science Curriculum Folder. • Introduction to the MakerSpace- Introduction to 3D Printing <p>Diversity, Equity & Inclusion Educational Resources https://www.nj.gov/education/standards/dei/</p>	<ul style="list-style-type: none"> • Use Close reading strategies to read and make annotations to the article called “What is Engineering?” • Use text evidence to respond to the comprehension questions. • View a Google slideshow called “Engineering Design Process” and follow the hyperdocs to complete a design challenge. • MakerSpace 101 tour and scavenger hunt NJSLA-S Practice Test

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Instructional Best Practices and Exemplars

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|---|--|
| 1. Identifying similarities and differences | 6. Cooperative learning |
| 2. Summarizing and note taking | 7. Setting objectives and providing feedback |
| 3. Reinforcing effort and providing recognition | 8. Generating and testing hypotheses |
| 4. Homework and practice | 9. Cues, questions, and advance organizers |
| 5. Nonlinguistic representations | 10. Manage response rates |

9.1 Personal Financial Literacy, 9.2 Career Awareness, Exploration, Preparation and Training & 9.4 Life Literacies and Key Skills

- 9.4.8.CT.3: Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome.
- 9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.
- 9.4.8.IML.12: Use relevant tools to produce, publish, and deliver information supported with evidence for an authentic audience.
- 9.4.8.TL.2: Gather data and digitally represent information to communicate a real-world problem (e.g., MS-ESS3-4, 6.1.8.EconET.1, 6.1.8.CivicsPR.4).
- 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.
- 9.4.8.TL.6: Collaborate to develop and publish work that provides perspectives on a real-world problem.

The implementation of the 21st Century skills and standards for students of the Winslow Township District is infused in an interdisciplinary format in a variety of curriculum areas that include, English language Arts, Mathematics, School Guidance, Social Studies, Technology, Visual and Performing Arts, Science, Physical Education and Health, and World Language.

Additional opportunities to address 9.1, 9.2 & 9.4:

Philadelphia Mint

<https://www.usmint.gov/learn/kids/resources/educational-standards>

Different ways to teach Financial Literacy.

<https://www.makeuseof.com/tag/10-interactive-financial-websites-teach-kids-money-management-skills/>

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Modifications for Special Education/504

Students with special needs: The students' needs will be addressed on an individual and grade level using a variety of modalities. Accommodations will be made for those students who need extra time to complete assignment. Support staff will be available to aid students related to IEP specifications. 504 accommodations will also be attended to by all instructional leaders. Physical expectations and modifications, alternative assessments, and scaffolding strategies will be used to support this learning. The use of Universal Design for Learning (UDL) will be considered for all students as teaching strategies are considered.

- Small group instruction
- Audio books/ Text-to-speech platforms
- Leveled texts/Vocabulary Readers
- Leveled informational texts via online
- Modeling and guided practice
- Read directions aloud
- Repeat, rephrase and clarify directions
- Extended time as needed
- Break down assignments into smaller units
- Provide shortened assignments
- Modify testing format
- Repeat directions as needed
- Graphic organizers
- Study Guides, Study Aids and Re teaching as needed

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Modifications for At-Risk Students

Formative and summative data will be used to monitor student success. At first signs of failure, student work will be reviewed to determine support. This may include parent consultation, basic skills review and differentiation strategies. With considerations to UDL, time may be a factor in overcoming developmental considerations

- Audio books and Text-to-speech platforms
- Leveled texts/Vocabulary Readers
- Leveled informational texts via online
- Extended time as needed
- Read directions aloud
- Assist with organization
- Use of computer
- Emphasize/highlight key concepts
- Recognize success
- Provide timelines for work completion
- Break down multi-step tasks into smaller chunks
- Provide copy of class notes and graphic organizer

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English Language Learners	Modifications for Gifted Students
<p>All WIDA Can Do Descriptors can be found at this link: https://wida.wisc.edu/teach/can-do/descriptors</p> <p><input type="checkbox"/> Grades 6-8 WIDA Can Do Descriptors:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Listening <input type="checkbox"/> Speaking <input type="checkbox"/> Reading <input type="checkbox"/> Writing <input type="checkbox"/> Oral Language <p>Students will be provided with accommodations and modifications that may include:</p> <ul style="list-style-type: none"> • Relate to and identify commonalities in Science studies in student’s home country • Assist with organization • Use of computer • Emphasize/highlight key concepts • Teacher Modeling • Peer Modeling • Label Classroom Materials - Word Walls 	<p>Students excelling in mastery of standards will be challenged with complex, high level challenges related to the topic.</p> <ul style="list-style-type: none"> • Raise levels of intellectual demands • Require higher order thinking, communication, and leadership skills • Differentiate content, process, or product according to student’s readiness, interests, and/or learning styles • Provide higher level texts • Expand use of open-ended, abstract questions • Critical and creative thinking activities that provide an emphasis on research and in-depth study • Enrichment Activities/Project-Based Learning/ Independent Study <p>Additional Strategies may be located at the links:</p> <ul style="list-style-type: none"> ❖ Gifted Programming Standards ❖ Webb’s Depth of Knowledge Levels and/or Revised Bloom’s Taxonomy ❖ REVISED Bloom’s Taxonomy Action Verbs

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Interdisciplinary Connections

ELA:

WHST.6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research.

Math:

7.EE.B.3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.
7.SP.C.7 Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.

Integration of Computer Science and Design Thinking NJSLS 8

8.1.8.DA.1: Organize and transform data collected using computational tools to make it usable for a specific purpose.
8.1.8.DA.5: Test, analyze, and refine computational models