Warren Township Public School District
Curriculum

Subject: Reach - Innovation & Design	**Grade: 4**	**Unit: Think Like An Engineer**
Total Number of Lessons: 10	**Unit Time Frame: one marking period (10 six-day cycles)**	

Instructional Materials (Include specific text or digital resource links that are used by teachers and students within the unit):

Reach Manual - Innovation & Design - 4th Grade, Reach Engineering Kit - Think Like an Engineer, legoeducation.com Spike Essential Lesson Website

Goals	**Skills / Understandings**
• Students will consider issues such as cost, environmental impact ("climate change"), and societal needs when designing engineering solutions. ("Financial Literacy") • Students will design multi-part machines that move using a source of energy including renewable energy. • Students will use evidence to defend their engineering design choices. • Students will integrate computing software into mechanical solutions to enhance a model's performance.	• Engineers use a complex set of factors to make design decisions such as costs, environmental impact, and societal and cultural concerns. • Renewable energy can be used to reduce the impact of climate change. • Design challenges become more complex when projects contain moving parts. • Engineers defend their design choices in front of their peers. • Software allows a model to be easily modified for different users who have different wants or needs such as people with "disabilities". • Algorithms can be looped in software to perform a task over and over again.

NJ Student Learning Standards and Descriptors:

3-ESS3-1: Make a claim about the merit of a design solution that reduces the impacts of climate change and/or a weather-related hazard.
4-PS3-2: Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
4-PS3-4: Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
4-ESS3-1: Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment ("climate change").
3-5-ETS1-1: 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-ETS1-2: 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-ETS1-3: 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.

Unit Essential Questions:	Student Vocabulary:	Lesson Learning Statement::
• How do engineers make decisions about the products they build? What factors affect these decisions? • If renewable energy is so great, why isn't everything run on renewable energy? • What information is in an engineering blueprint? • How do I design a machine with moving parts? • What constitutes evidence and how can I best use it to defend my engineering choices? • How can computers improve my models? • How do I create a program that is flexible enough to accommodate lots of differences in users?	• engineering design process (EDP) • Human-made • Nature-made • Motor • solar panel • Petroleum • Hydropower • water wheel • environmental impact • societal concerns • Evidence • Defend • Factors • Constraints • success criteria • Innovation • Weakness • Strength • Half-inch • test plan • Evaluate • Analyze • Scenario • Algorithm • Loop • Sequence • Mechanical	• Engineers make complex design decisions taking into account lots of different issues. • Engineers choose energy sources for their machines based on project constraints and success criteria. • Engineers innovate a product by exploring how to improve a weakness or an area in which the product does not meet the success criteria. • Engineers build from blueprints, test from a test plan, and redesign based on an analysis of their test results. • Engineers explain and defend their design choices using evidence. • Mechanical models can be improved by adding computing software. • People have different needs and wants. Software can help us modify a product to accommodate differences ("Disabilities", "Amistad")

Interdisciplinary Connections (include standard number and activity examples):	**Assessment Strategies / Resources:**	**Benchmark Assessments / Products: Specific common assessments both formative and summative (provide a link to the assessments)**
PS3.A: Definitions of Energy: ● Energy can be moved from place to place by moving objects or through sound, light, or electric currents. (4-PS3-2), (4-PS3-3) Influence of Science, Engineering, Technology, and Applications of Science: ● Engineers improve existing technologies or develop new ones. (4-PS3-4) ● Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands. (4-PS3-4) Connections to Nature of Science: Science is a Human Endeavor ● Most scientists and engineers work in teams. (4-PS3-4) ● Science affects everyday life. (4-PS3-4) ● Light also transfers energy from place to place. (4-PS3-2) ● Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. (4-PS3-2), (4-PS3-4) PS3.D: Energy in Chemical Processes and Everyday Life: ● The expression “produce energy” typically refers to the conversion of stored energy into a desired form for practical use. (4-PS3-4)	Pre- and post-tests Rubrics Self-assessment rework	Innovation & Design Grade 4 post assessment

Connections to Engineering, Technology, and applications of Science - Interdependence of Science, Engineering, and Technology: ● Knowledge of relevant scientific concepts and research findings is important in engineering. (4-PS4-3) Systems and System Models: A system can be described in terms of its components and their interactions. (4-LS1-1), (4-LS1-2) ETS1.A: Defining and Delimiting Engineering Problems ● 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) ETS1.B: Developing Possible Solutions: ● Research on a problem, such as climate change, 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) ● 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) ● Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5-ETS1-3) ETS1.C: Optimizing the Design Solution: ● 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)		

Influence of Engineering, Technology, and Science on Society and the Natural World: ● People's needs and wants change over time, as do their demands for new and improved technologies. (3-5-ETS1-1) Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5-ETS1-2)		

21st Century Life and Careers - Technology (link to standard 8.1 and 8.2) / Career and 21st Century Skills (link to standard 9.1, 9.2, 9.2)
(Include standard number and activity examples from each area):

- 9.45.CI.1: Use appropriate communication technologies to collaborate with individuals with diverse perspectives about a local and/or global climate change issue and deliberate about possible solutions.
- 9.4.5.CI.3: Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity.
- 9.4.5.CI.4: Research the development process of a product and identify the role of failure as a part of the creative process.
- 9.4.5.CT.1: Identify and gather relevant data that will aid in the problem-solving process.
- 9.4.5.CT.3: Describe how digital tools and technology may be used to solve problems.
- 9.4.5.CT.4: Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community, and global.
- 9.4.2.TL.7: Describe the benefits of collaborating with others to complete digital tasks or develop digital artifacts.
- 9.4.2.GCA.1: Articulate the role of culture in everyday life by describing one's own culture and comparing it to the cultures of other individuals.
- 9.4.2.IML.2: Represent data in a visual format to tell a story about the data.

Warren QSAC Accommodations Chart:

Collaboration, vocabulary definitions poster, Engineering Design Process poster, verbal and written directions, job specialization opportunities, scenario based learning