

Englewood Public School District

Technology

High School

The Nature of Technology

Overview: Over the course of the school year, students will study and implement the use of technology throughout the core subjects. Students will research technology, solve problems, and create their own technologies to address issues in science, social studies, mathematics, and English language arts.

Time Frame: One school year

Enduring Understandings:

Technology is an integral part of 21st century life and skills.

Technology can be used to enhance what we learn.

We can use technology to help and teach others.

Essential Questions:

How can we make the best use of technology?

How does technology fit into what we are learning? How can it help us to learn?

What are the risks and rewards of using technology?

Standards	Topics and Objectives	Activities	Resources	Assessments
8.2.A Creativity and Innovation 8.2.12.A.1 Propose an innovation to meet future demands supported by an analysis of the potential full costs, benefits, trade-offs and risks, related to the use of the innovation. 8.2.12.A.2 Analyze a current technology and the resources used, to identify the trade-offs in terms of	Topics The Characteristics and Scope of Technology The Core Concepts of Technology Technology and Other Fields Twenty-First Century Themes and Skills include: <ul style="list-style-type: none"> Informational Literacy Media Literacy Creativity and Innovation 	In English, mathematics, science and social studies, students will use appropriate data to discuss the full costs, benefits and trade-offs, and risks related to the use of selected technologies. Students will explain how technological development is affected by competition through a variety of management activities associated with planning, organizing, and controlling the enterprise.	Transportation Fuels: The Future is Today, US Dept. of Energy www.formula-hybrid.org/wp-content/uploads/DOE-Alternative-Fuels-Teacher-Guide.pdf Electric Messages: Then and Now, Try Engineering http://tryengineering.org/sites/default/files/lessons/electricmess ages.pdf Mobile Phones, British Council	Students will be evaluated on the quality of their participation and completion of the activities: <ol style="list-style-type: none"> 1. Transportation Fuels: The Future Is Today 2. RST: How Tech. Shaped History 3. RST: How a Tech. Affected a Specific Time Period 4. What Changed the World the Most? 5. The Triumph of Steam and Electricity

availability, cost, desirability and waste.

8.2.12.A.3 Research and present information on an existing technological product that has been repurposed for a different function.

- Critical Thinking and Problem Solving
- Communication and Collaboration

Objectives

- Students will propose an innovation that addresses a future need based upon research and supported speculation.
- Students will identify the tradeoffs of an existing technology.
- Students will suggest a way to upcycle a given technological product.

When writing a Research Simulation Task in English, students will provide various examples of how technological developments have shaped human history.

When writing a Research Simulation Task in English, students will investigate and report on a technology used in a given period of history.

Transportation Fuels: The Future is Today

This resource is a series of cooperative learning activities in which secondary students evaluate the advantages and disadvantages of conventional and alternative transportation fuels for themselves and their communities. US Dept. of Energy

Throughout the study of history in World History, US I and US II, students will determine the impact and changes made to meet human wants and needs.

Throughout the study of history in World History, US I and US II, students will research how and the extent to which a particular technology brought about massive social, economic and cultural changes.

What Changed the World the Most?

In World History, students write an essay answering the Essential

<http://www.teachingenglish.org.uk/sites/teacheng/files/mobile-phone-lesson-plan.pdf>

6. Industrial Age Inventors
7. Morse Code
8. Motion Pictures
9. Media and Technologies Role in Politics
10. Electric Messages: Then and Now
11. Mobile Phones

Question: What changed the world the most between 1400 and 1800—trade, travel, weaponry, or ideas? MP1 – 500 C.E. to 1800 C.E.

The Triumph of Steam and Electricity

In World History, students will examine and analyze an English lithograph, “The Triumph of Steam and Electricity,” commemorating the Diamond Jubilee (60th anniversary) of Queen Victoria, and use it to answer questions relative to “What was so revolutionary about the Industrial Revolution?” MP2 – Revolution

Industrial Age Inventors

In US I, students will research Industrial Age inventors and their inventions. Then, students will research manufacturing and technology problems during the Industrial Age and invent their own machines to solve a problem. Students will create posters that depict their invention and explain how it works and what problem it solves. MP2 – America from 1789 – 1855

Morse Code

In US I, students will research the inventions of Morse code, the refrigerator, and the telephone and consider the implications of these inventions’ introductions. MP3 – America from 1846 – 1900

Motion Pictures

In US I, students will watch one of the world's first motion pictures and read about the history of the motion picture. MP4 – The Rise of the West to the Progressive Era

Media and Technologies Role in Politics

In US II, students examine media and technology's role on political issues by examining numerous resources and considering, "What is social media's role in Election 2016?" MP4 – Vietnam to Present

Electric Messages: Then and Now

Lesson focuses on exploring electric message systems, from light signals using International Morse Code to text messaging. Students construct a simple telegraph using a battery, wires, a switch, and bulb, and explore the impact of communications on society. Try Engineering

Mobile Phones

In this lesson students will create and perform telephone conversations, decipher text messages, and write and send their own. The lesson considers the importance of mobile phones for people today and how texting has changed the way they communicate. British Council

8.2.B Technology and Society

8.2.12.B.1 Research and

Topics
The Effects of Technology

In science, students will analyze a given technological product, system, or environment to understand how the engineering

Manufacture Your Future,
Discovery Education
[www.manufactureyourfuture.co
m/sites/manufactureyourfuture.](http://www.manufactureyourfuture.com/sites/manufactureyourfuture)

Students will be evaluated on the quality of their participation and completion of the activities:

analyze the impact of the design constraints (specifications and limits) for a product or technology driven by a cultural, social, economic or political need and publish for review.	Technology and the Environment	design process and design specification limitations influenced the final solution.	pdf	1. Retrofitting Suburbia
8.2.12.B.2 Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation and maintenance of a chosen product.	Societal Use of Technology		Urbanization and the Evolution of Cities Across 10,000 Years, TedEd Lessons http://ed.ted.com/lessons/urbanization-and-the-future-of-cities-vance-kite	2. Conservation Maps
8.2.12.B.3 Analyze ethical and unethical practices around intellectual property rights as influenced by human wants and/or needs.	Technology and History	<u>Retrofitting Suburbia</u> In Environmental Science, student will watch Urbanization and the Evolution of Cities Across 10,000 Years and Retrofitting Suburbia , participate in an online quiz and discussion. MP3 – Earth’s Resources	http://ed.ted.com/lessons/ellen-dunham-jones-retrofitting-suburbia	3. Environmental Hazards
8.2.12.B.4 Investigate a technology used in a given period of history, e.g., stone age, industrial revolution or information age, and identify their impact and how they may have changed to meet human needs and wants.	Twenty-First Century Themes and Skills include:	<u>Conservation Maps</u> In Environmental Science, students will explore Conservation Maps for a global perspective of land use and conservation efforts. MP3 – Earth’s Resources	Retrofitting Suburbia, TedEd Lessons http://ed.ted.com/lessons/ellen-dunham-jones-retrofitting-suburbia	4. Greenhouse Effect
8.2.12.B.5 Research the historical tensions between environmental and economic considerations as driven by human needs and wants in the development of a technological product, and present the competing viewpoints to peers for review.	<ul style="list-style-type: none"> • Informational Literacy • Media Literacy • ICT Literacy • Creativity and Innovation • Critical Thinking and Problem Solving • Communication and Collaboration <p>Objectives</p> <ul style="list-style-type: none"> • Students will evaluate or refine a technological solution to reduce the impact of humans on natural systems. • Students will use multiple sources and sustained research to present and identify the issue and prior attempts to solve it. • Students will collaborate online to further research other perspectives on the issue(s), previous solutions and their impact(s). • Students will pose a self-generated question to prepare a report to increase knowledge and awareness regarding the issues. 	<p>In science, students will evaluate the function, value, and appearance of technological products, systems, and environments from the perspective of the user and the producer.</p> <p>In science, students will develop methods for creating possible solutions, modeling and testing solutions, and modifying proposed designs in the solution of a technological problem using hands-on activities.</p> <p>In science, students will diagnose a malfunctioning product and system using appropriate critical thinking methods.</p> <p>In science, students will create a technological product, system, or</p>	<p>Interactive Conservation Maps, TNC Maps http://maps.tnc.org/web_maps.html</p> <p>Environmental Hazards on the Farm, PBS Learning Media http://florida.pbslearningmedia.org/resource/envh10.sci.life.eco.hazardfarm/environmental-hazards-on-the-farm/</p> <p>Environmental Hazards at the Coast, PBS Learning Media http://florida.pbslearningmedia.org/resource/envh10.sci.life.eco.hazardcoast/environmental-hazards-at-the-coast/</p> <p>Environmental Hazards in the City, PBS Learning Media http://florida.pbslearningmedia.org/resource/envh10.sci.life.eco.hazardcity/environmental-hazards-in-the-city/</p> <p>The Greenhouse Effect, PhET</p>	5. Manufacture Your Future

8.2.C Design

8.2.12.C.1 Explain how open source technologies follow the design process.

- Students will demonstrate understanding by recommending strategies to decrease or resolve the issue.
- Students will hone their understanding of intellectual property rights.

environment using given design specifications and constraints by applying design and engineering principles.

Environmental Hazards

In Environmental Science, students will explore the [Environmental Hazards on The Farm](#), [Environmental Hazards at the Coast](#), and [Environmental Hazards in the City](#) interactive simulations. MP1 – Introduction to Environmental Science

Greenhouse Effect

In Environmental Science, students explore the [Greenhouse Effect](#) simulation to model the atmosphere during the ice age and today. MP3 – Earth’s Resources

Manufacture Your Future

In US II, students experience a Problem-Based Unit called “Manufacture Your Future” to gain a firsthand understanding of how manufacturing has changed over time and the opportunities students have to engage with technologies used by engineers and designers. Discovery Education. MP4 – Vietnam to Present

Interactive Simulations

<https://phet.colorado.edu/en/simulation/greenhouse>

Topics

Attributes of Design

Applications of Engineering Design

In science, students will explain the life cycle of a product from initial design to reuse, recycling, remanufacture, or final disposal, and its relationship to people, society, and the environment, including conservation and

Sustainable Cities: Nature Based Solutions in Urban Design, PBS Learning Media <http://florida.pbslearningmedia.org/resource/nature-works-everywhere-sustainable-cities/nature-works->

Students will be evaluated on the quality of their participation and completion of the activities:

1. Water Sanitation
2. Sustainable Cities
3. Electromagnetic

<p>8.2.12.C.2 Analyze a product and how it has changed or might change over time to meet human needs and wants.</p> <p>8.2.12.C.3 Analyze a product or system for factors such as safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, and human factors engineering (ergonomics).</p> <p>8.2.12.C.4 Explain and identify interdependent systems and their functions.</p> <p>8.2.12.C.5 Create scaled engineering drawings of products both manually and digitally with materials and measurements labeled.</p> <p>8.2.12.C.6 Research an existing product, reverse engineer and redesign it to improve form and function.</p> <p>8.2.12.C.7 Use a design process to devise a technological product or system that addresses a global problem, provide research, identify trade-offs and constraints, and document the process through drawings that</p>	<p>Inventions and Innovations</p> <p>Twenty-First Century Themes and Skills include:</p> <ul style="list-style-type: none"> • Informational Literacy • ICT Literacy • Creativity and Innovation • Critical Thinking and Problem Solving • Communication and Collaboration <p>Objectives</p> <ul style="list-style-type: none"> • Students will explain open source technologies. • Students will analyze the development of a product throughout its lifetime. • Students will analyze the impact of particular products on the environment and humans. • Students will create a scale drawing of a product. • Students will reverse engineer a product. • Students will construct a product that addresses a global problem. 	<p>sustainability principles.</p> <p>In science, students will analyze the factors that influence the design of products, systems, and environments.</p> <p>In English, mathematics, science and social studies, students will compare and contrast the effectiveness of various products, systems, and environments associated with technological activities in energy, transportation, manufacturing, and information and communication.</p> <p>In science and mathematics, students will create a scaled drawing of a product with exact measurements.</p> <p>In science, students will construct an innovation that improves upon an existing product and addresses a global problem.</p> <p><u>Water Sanitation</u> In Environmental Science, students explore how cost-benefit analysis is applied to water sanitation in order to apply this model to design solutions related to human sustainability. MP4 – Toward a Sustainable Future</p> <p><u>Sustainable Cities</u> In Environmental Science, students will use nature-based solutions to solve urban sustainability issues in the Sustainable Cities activity. MP4 –</p>	<p>everywhere-sustainable-cities/</p> <p>Electromagnetic Spectrum, NASA http://imagine.gsfc.nasa.gov/science/toolbox/emspectrum_obse rvatories1.html</p> <p>Electric Current, The Concord Consortium https://concord.org/stem-resources/electric-current</p> <p>Parallel Resistance, The Concord Consortium https://concord.org/stem-resources/dc-circuits-parallel-resistances-sparks-2</p> <p>Series Resistance, The Concord Consortium https://concord.org/stem-resources/dc-circuits-series-resistances-sparks-1</p> <p>Parallel Resistance, The Concord Consortium https://concord.org/stem-resources/dc-circuits-series-parallel-resistances-sparks-3</p>	<p>Spectrum</p> <ol style="list-style-type: none"> 4. Electric Current 5. DC Circuits
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include data and materials.

Toward a Sustainable Future

Electromagnetic Spectrum

In Physics, students will explore NASA's websites [Introduction to the Electromagnetic Spectrum](#) and [Technology for Imaging the Universe](#) to gather background information on the topic. MP3 – Waves, Sound, and Electromagnetic Radiation

Electric Current

In Physics, students will explore the relationships between voltage, current, and resistance that make up Ohm's Law using molecular models of circuits in the [Electric Current](#) simulation. MP3 – Waves, Sound, and Electromagnetic Radiation

DC Circuits

In Physics, students will explore DC circuits in the [Parallel Resistances](#), [Series Resistances](#), and [Series-Parallel Resistances](#) simulations. MP3 – Waves, Sound, and Electromagnetic Radiation

8.2.D Abilities for a Technological World

8.2.12.D.1 Design and create a prototype to solve a real world problem using a design process, identify constraints addressed during the creation of the prototype, identify trade-offs made, and present the

Topics	My NASA Data	My NASA Data, NASA	Students will be evaluated
Apply the Design Process	In Environmental Science, students will select satellite datasets using the MY NASA DATA interactive website to answer questions related to system interactions and feedbacks. MP 1 – Introduction to Environmental Science	https://mynasadata.larc.nasa.gov/v/	on the quality of their participation and completion of the activities:
Technological Products and Systems		African Lions, The Concord Consortium	1. My NASA Data
Impact of Products and Systems		https://concord.org/stem-resources/african-lions-modeling-populations	2. African Lions
Twenty-First Century Themes and Skills include:	African Lions In Environmental Science,	Carbon Stabilization Wedge, Princeton University	3. Carbon Stabilization Wedge
			4. Beneficial Bacteria
			5. Properties of Gas
			6. Ramp Game
			7. Parachutes and Velocity

<p>solution for peer review.</p> <p>8.2.12.D.2 Write a feasibility study of a product to include: economic, market, technical, financial, and management factors, and provide recommendations for implementation.</p> <p>8.2.12.D.3 Determine and use the appropriate resources (e.g., CNC (Computer Numerical Control) equipment, 3D printers, CAD software) in the design, development and creation of a technological product or system.</p> <p>8.2.12.D.4 Assess the impacts of emerging technologies on developing countries.</p> <p>8.2.12.D.5 Explain how material processing impacts the quality of engineered and fabricated products.</p> <p>8.2.12.D.6 Synthesize data, analyze trends and draw conclusions regarding the effect of a technology on the individual, society, or the environment and publish conclusions.</p>	<ul style="list-style-type: none"> • Informational Literacy • ICT Literacy • Creativity and Innovation • Critical Thinking and Problem Solving • Communication and Collaboration <p>Objectives</p> <ul style="list-style-type: none"> • Students will design a prototype to solve a real world problem. • Students will write a feasibility study of a product. • Students will select the appropriate resources to develop a product. • Students will consider the impact of emerging technologies on developing countries. • Students will identify the impact of using one material over another and its impact on the quality of the product. • Students will synthesize data regarding the effect of a specific technology on humans and the environment. 	<p>students use the data presented in the African Lions Activity to make a prediction regarding the zebra population during periods of increased rainfall. MP 1 – Introduction to Environmental Science</p> <p><u>Carbon Stabilization Wedge</u> In Environmental Science, students play the Carbon Stabilization Wedge game in order to evaluate competing design solutions for developing, managing, and utilizing energy resources based on cost-benefit ratios. MP4 – Toward a Sustainable Future</p> <p><u>Beneficial Bacteria</u> In Biology, students will observe the everyday uses of fermentation in the video “The Beneficial Bacteria that Make Delicious Food.” MP2 – Matter and Energy Transformations in Living Systems</p> <p><u>Properties of Gas</u> In Chemistry, student will use the Gas Properties, Gas Laws, Temperature-Pressure Relationship, Temperature-Volume Relationship, and Volume Pressure Relationship simulations to explore the interrelationships of pressure, temperature, and volume with atomic models. MP3 – Energy and Rates of Reaction</p> <p><u>Ramp Game</u> In Physics, students will create and race a virtual car and analyze data</p>	<p>http://cmi.princeton.edu/wedges/game.php</p> <p>Gas Properties Simulations, PhET Interactive Simulations https://phet.colorado.edu/en/simulation/gas-properties</p> <p>Ramp Game, The Concord Consortium https://concord.org/stem-resources/ramp-game</p> <p>Parachute Model, The Concord Consortium https://concord.org/stem-resources/parachute-model</p> <p>Parachute and Terminal Velocity, The Concord Consortium https://concord.org/stem-resources/parachute-and-terminal-velocity</p> <p>Gravity Force, PhET Interactive Simulations https://phet.colorado.edu/en/simulation/gravity-force-lab</p> <p>Build a Solar House, The Concord Consortium https://concord.org/stem-resources/model-solar-house</p> <p>Sound Waves, PhET Interactive Simulations https://phet.colorado.edu/en/simulation/sound</p>	<p>8. Gravity Force</p> <p>9. Build a Solar House</p> <p>10. Sound Waves</p>
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in the [Ramp Game](#) simulation.
MP1 – Motion, Forces and
Newton’s Laws

Parachutes and Velocity

In Physics, students will explore gravity, freefall, and air resistance in the simulations [Parachute Model](#) and [Parachute and Terminal Velocity](#). MP1 – Motion, Forces and Newton’s Laws

Gravity Force

In Physics, students will visualize the gravitational force that two objects exert on each other in the [Gravity Force Lab](#) simulation and complete a [Lab Sheet](#). MP2 – Gravitation, Rotation Motion, Momentum and Energy Conservation

Build a Solar House

In Physics, students will construct and measure the energy efficiency and solar heat gain of a cardboard model house in the simulation [Build a Solar House](#). MP2 – Gravitation, Rotation Motion, Momentum and Energy Conservation

Sound Waves

In Physics, students will adjust the frequency to both see and hear how the wave changes to explain how different sounds are modeled, described, and produced in the [Sound Waves](#) simulation. MP3 – Waves, Sound, and Electromagnetic Radiation

<p>8.2.E Computational Thinking: Programming</p> <p>8.2.12.E.1 Demonstrate an understanding of the problem-solving capacity of computers in our world.</p> <p>8.2.12.E.2 Analyze the relationships between internal and external computer components.</p> <p>8.2.12.E.3 Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).</p> <p>8.2.12.E.4 Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).</p>	<p>Topics</p> <p>Tools Used in Design and Engineering</p> <p>Twenty-First Century Themes and Skills include:</p> <ul style="list-style-type: none"> • Informational Literacy • ICT Literacy • Critical Thinking and Problem Solving <p>Objectives</p> <ul style="list-style-type: none"> • Students will explain how computers solve specific challenges. • Students will explain the relationship of hardware and software. • Students will employ simple computer programming and coding to accomplish a task. 	<p><u>Ecological Footprint</u> In Biology, students will investigate how much land area it takes to support their lifestyle using the Ecological Footprint Calculator. MP3 – Human Activity and Biodiversity</p> <p><u>School Energy Use</u> In Biology, students investigate how much energy they use at school and the financial and environmental cost in the activity “Know Your Energy Costs.” MP3 – Human Activity and Biodiversity</p> <p><u>National Climate Assessment</u> In Biology, students explore the National Climate Assessment to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. MP3 – Human Activity and Biodiversity</p>	<p>Ecological Footprint Calculator, Global Footprint Network http://www.footprintnetwork.org/en/index.php/GFN/page/calculators/</p> <p>National Climate Assessment, GlobalChange.gov http://nca2014.globalchange.gov/</p>	<p>Students will be evaluated on the quality of their participation and completion of the activities:</p> <ol style="list-style-type: none"> 1. Ecological Footprint 2. School Energy Use 3. National Climate Assessment
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Modifications:

- New Jersey Department of Education – Instructional Supports and Scaffolds
- Suggested Strategies for English Language Learners
- The Nature of Technology curricula provides enrichment activities that allow for greater personalized learning to meet the needs of all learners including students with gifts and talents.

Vocabulary:

Accidental Discovery - The act or an instance of discovering any event that happens unexpectedly, without a deliberate plan or cause.

Alternative - A choice or option that might solve a given problem.

Brainstorming - The technique of solving specific problems by gathering ideas from a group where there are no wrong answers.

Constraint - A limitation or restriction.

Copyright Law - The law that protects the exclusive legal right to reproduce, publish, sell, or distribute the matter and form of something.

Criteria - List of requirements, rules or principles for evaluating or testing something.

Culture - The behaviors and beliefs characteristic of a particular social, ethnic, or age group.

Define the Problem - Understanding the problem.

Design - To prepare the preliminary sketch, drawing also known as the plans.

Design Criteria - The criteria that designers should meet in designing a system or device.

Drawing - A sketch, plan, or design.

Educated Guess - An estimate or guess based on knowledge and experience, making it more likely to be correct.

Hacker - An unauthorized person who secretly gains access to computer files.

Implementation - The act of putting a solution in place.

In-sight - An understanding of relationships that sheds light on or helps solve a problem.

Limitation - Something that limits; a rule, a boundary, a limitation or a restriction.

Luxury - A good or service that is not required or indispensable.

Methodology - A group of methods, hypotheses, and rules used by a field of study to resolve problems or to maintain useful practices.

Model - An example that shows the construction or appearance of something.

Optimize - To make as effective, perfect, or useful as possible.

Past Experience - Knowledge or practical wisdom gained from what one has observed, encountered, or undergone.

Principle - The basic way something works; also, the model of quality or right-and-wrong that people follow in life.

Problem Solving - The process of working through details of a problem to reach a solution.

Prototype - A full scale working model, the original or model on which something is based or formed.

Risk Benefit trade-off - Direct relationship between possible risk and possible reward that holds for a particular situation. To realize greater reward one must generally accept a greater risk, and vice versa.

Sector - A pie-shaped part of a circle; also, a part of an area where military forces are in control.

Sketch - A rough design, plan, or draft, of a possible solution.

Specifications - A detailed description or assessment of requirements, dimensions, and materials, etc.

System - A method of achieving a desired result.

System of Production - A method used in assembly to create goods and conveniences from various resources.

Social-technical system - The means by which the interaction between people and technology in workplaces is designed so that complex organizational work may be carried out with minimal waste of time and resources.

Solution - The results of problem solving; an explanation or answer.

Trade-off - The exchange of one thing for another of more or less equal value, especially to affect a compromise.

Trial And Error - A procedure for solving problems through step-by-step exploration, and by employing known criteria to unknown factors.

Values - Certain qualities and beliefs that are shared within a specific culture or group of people. These traits can be religious, economic, political, etc.

Worm- A computer file designed to do damage that goes through a computer and possibly a network.